Vol. 51 No. 4 April 1958

Quarterly

of the

National Fire Protection Association

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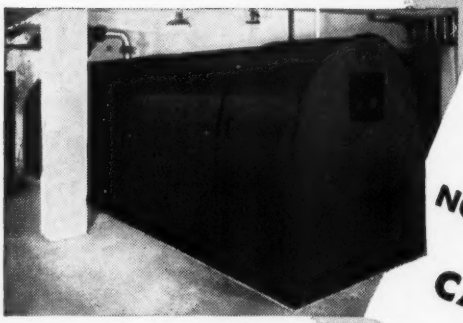

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Vol. 51 No. 4 April 1958

Quarterly

The Standard Technical Journal of Fire Protection for More Than Forty Years

The NFPA is a non-profit technical and educational organization devoted to the reduction of loss of life and property by fire with a total membership of 17,000. The *Quarterly* is one of the publications regularly provided to members. Other membership publications include *Fire News*, *Advance Reports* to the Annual Meeting, a *Year Book*, and many leaflets, pamphlets and posters issued throughout the year on fire prevention and control. Six volumes of the National Fire Codes are available on an annual subscription basis, one volume free and others at reduced membership rates. For full details on available material ask for the free "List of NFPA Publications."

NFPA annual dues are $15.00 for Associate Membership of which $6.00 is for subscription to this Journal. National and regional societies or associations may apply for an organization membership for which annual dues are $100; such a membership entitles four individuals to receive the periodical membership publications.

Technical committees of the Association develop means to safeguard life and property through the publication of standards covering all phases of fire prevention and protection. Your membership in the Association affords an opportunity to keep abreast of these developments and, by being a member, you help support this humanitarian activity. Popular educational literature on fire safety is constantly being produced by the NFPA for distribution through its members to the general public.

National Fire Protection Association

International

60 Batterymarch Street Boston 10, Mass., U.S.A.

Entered as second-class matter December 15, 1928, at the Post Office at Boston, Mass., under act of March 3, 1879.

Printed in U.S.A.

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Quarterly
of the
NATIONAL FIRE PROTECTION ASSOCIATION

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Articles and accounts of fires appearing in the Quarterly are based on material forwarded to the Association. The Association, as a body, does not assume responsibility for the accuracy of the material printed herein.

This publication is indexed by Engineering Index, Inc

Courtesy County of Los Angeles Fire Department

A helicopter view of shingle roofs in a subdivision in the Los Angeles area. Mr. Bugbee warns in the following article of the conflagration hazard presented by such wood shingle concentrations.

Conflagration Warning

By Percy Bugbee, General Manager

National Fire Protection Association

The early spring of 1916 in the South was a period of prolonged dry weather and high winds. On March 21 of that year, Paris, Texas, was practically destroyed by fire. Fourteen hundred and forty buildings were involved. The fire spread over wood shingle roofs. The winds picked up the burning shingles and dropped them on other wood shingle roofs all over the city. There isn't a fire department anywhere that could have coped with this situation.

The very next day under identical conditions a conflagration broke out in Nashville, Tenn. and 648 buildings were destroyed. On the same day and under exactly the same conditions, 682 buildings were destroyed in Augusta, Ga.

If any student of fire experience ever needed convincing arguments as to the conflagration hazards presented by large accumulations of wood shingle roofs on dwellings, these experiences should suffice.

A few years ago the NFPA published a study of conflagrations in America between 1900 and 1950*. The study covered some 133 major conflagrations in that period and of these it was shown that 63 of them were spread by sparks on wood shingle roofs.

Because of the very bad conflagration record of wood shingle roofs in the early part of the century, the NFPA devoted a substantial amount of time and attention to attacking this particular hazard when it established its field service operations. During the 1920's and 1930's the NFPA pounded away at this hazard and numerous cities all over the United States adopted local ordinances prohibiting the use of wood shingle roof coverings throughout city limits. The wood shingle roof practically disappeared in many sections of the country. As a consequence, conflagrations from wood shingles have disappeared and fires from sparks on roofs, which plagued many fire departments, have been very substantially eliminated.

New Conflagration Threat Today

In the last few years we have been considerably concerned by the reappearance in substantial quantities of wood shingle roofs, particularly in areas of southern California and certain sections of Texas. Large tracts of new housing developments are making their appearance in these areas with all of the dwellings covered with wood shingle roofs. It hardly seems necessary to observe that in southern California and Texas prolonged dry spells and high winds are possible and that in these areas conflagration hazards are being re-created. Needless to say, the NFPA has been vigorously calling attention to these conditions but, so far, no visible action to correct them has been forthcoming. Must we wait for another serious conflagration?

Wood Shingle Propaganda

Encouraged by the fact that wood shingles are gaining acceptance in certain areas and because there exists a general public apathy brought about by the lack of conflagrations in recent years which is a direct result of the very substantial increase in use of fire retardant roof coverings, the lumber industry is presently undertaking a widespread campaign to bring back the wood shingle roof. The industry is concentrating its current efforts on an attempt to knock

*See Conflagrations in America since 1900, NFPA, 1951. 66 pages, Price $1.00.

out the insurance rate differentials on private dwellings which favor fire retardant roof coverings as against wood shingle roof coverings. This insurance rate differential has been in effect in most sections of the country for many years. Let's look at Exhibit A. The following letter was sent to the Secretary of the Michigan Association of Insurance Agents by the Secretary of the Michigan Retail Lumber Dealers Association some months ago:

"In your dealings with member agents you probably have run into some phase of the asphalt vs. wood shingle insurance rate differential. In the hope that your upcoming meeting might provide a sounding board for your agents' reaction, I would like to outline a few of the factors behind our feeling that this discriminatory rate should be equalized in Michigan, whether it is accomplished by lowering wood shingle to asphalt rate or raising asphalt to the wood shingle level:

"1. This rate discrimination appears to be based on hazard factors which have become minimum.

"a. Fire occurrence from exterior causes has dropped to negligible levels with the virtual elimination of cinder and spark producing fuels in most areas, both for home consumption and railroads.

"b. Combustibility of asphalt vs. wood roof coverings on internally caused fires is negligible, plus the fact that heated asphalt dripping into burning houses causes greater interior damage than when there are wood shingles (of importance from insurance angle).

"c. Durability of wood shingles under rain-windstorm conditions — wood shingles expand when moist and tend to tighten bond to the roof, producing less blow-off damage.

"Much of the reason for the widespread distribution of asphalt shingles in Michigan can be found in the insurance rate differential between asphalt and wood shingles, for aside from the actual difference in insurance cost on the two jobs there is the even more psychological factor in the buyer's mind that wood will not provide as good protection. The rate differential indicates this.

"If this hazard differential were currently real, there would be no justification for ten states to have eliminated the rate discrimination as such populous areas as New York, Rhode Island, Wisconsin and others have done. Among the states retaining a rate differential there is such wide divergence from microscopic differences to exorbitant spreads that one can doubt their overall validity.

"You may wonder why a lumber association is interested in achieving this rate equalization between products when a majority of dealers are predominately selling asphalt products. The basic reason is to eliminate the artificially induced prejudice against wood as a building material that unfortunately comes with preferential treatment that asphalt receives from insurance rates. I would very much appreciate your group's reaction towards working out a procedure to work towards this rate equalization."

I think that it might be appropriate to include herewith the letter that the NFPA sent to the Secretary of the Michigan Retail Lumber Dealers Association in answer to this proposal.

"The Secretary of the Michigan Association of Insurance Agents has kindly sent us a copy of your letter of February 18 to him and has suggested that we might give you our comments on the matters raised in your letter.

"The National Fire Protection Association is not an insurance rating organization. Decisions are made with respect to insurance rates by those organizations to which the insurance companies have given this specific responsibility.

"We cannot agree with your observation that the hazardous factors of wood shingles do not any longer exist. Wood shingles will ignite from a small shower of sparks and when burning give off dangerous flying brands. We recommend the use of roofing materials which will not ignite from a shower of small sparks and will not give off flying brands. There is a very real difference between wood shingles and many other types of roofing because of this fire hazard feature of wood shingles.

"The reduced frequency of fires in cities is due in part to one fact you haven't mentioned, namely, that there are fewer and fewer wood shingles being put on houses. Your comment about heated asphalt as a damage factor is not supported by any data that has ever come to our attention. Wood shingles are not more durable than competitive shingles. Several makes of competitive asphalt shingles currently provide roofs tighter to wind-driven rain than wood shingles and all makes can easily provide this and probably will soon. Wood shingles tend to curl and split under weathering and this is one of the factors which increases their fire hazard due to age.

"As you may be aware, in the early part of the century city after city in the United States was devastated by wood shingle roof conflagrations. Because of that experience, our Association over many years has advocated strongly the elimination of wood shingles as a roof covering. Any move that would tend once again to encourage widespread use of wood shingles as roof coverings would bring back the areas of combustible roofs which would again produce the threat of conflagrations.

"Premium payers, not insurance companies, have to pay for conflagrations. Consequently we consider wood shingle roofs contrary to the public interest.

"If you were a citizen whose home was located down-wind from a spreading conflagration and the roof of your house was being subjected to a shower of sparks, the difference between a wood shingle roof and a roof that would resist this shower of sparks would not, we are sure, appear to be unimportant."

Now let us turn to Exhibit B. There is a fraternal order of lumbermen in this country known as the "Concatenated Order of Hoo-Hoo's." This organization is currently undertaking a campaign to influence insurance commissioners to eliminate the insurance rate differential against wood shingle roofs. Here is a letter written recently by the Secretary of the Denver Hoo-Hoo Club No. 74:

"Dear Hoo-Hoo Member:

"As all Hoo-Hoo brothers know, the promotion of wood building materials is the fundamental purpose and policy of our organization and this includes the protection of wood products against unjust and discriminatory legislation, insurance rates, etc.

"Here in Colorado we have a situation which discriminates against the public acceptance of wood shingles and shakes and which we think is logical for Hoo-Hoo members to rally against. We refer to the surcharge or differential in fire insurance rates which apply against dwellings with wood roofs. Actually, this is an old situation which can be traced back to a few conflagrations which occurred during the early years of this century when construction conditions were vastly different from what they are today. There is no justification whatsoever for permitting these wood shingle insurance surcharges to continue and it behooves every Hoo-Hoo member in Colorado to register his protest by signing a petition directed to our state insurance commissioner.

"You will find the petition enclosed and we urge that you get as many of your friends and acquaintances as possible to sign. Please return the filled out petition to me no later than January 10, 1958.

"Last November the State of Rhode Island became the tenth state to outlaw the wood shingle surcharges, and this came about as the direct result of work on the part of the Providence Hoo-Hoo Club. Right now the Hoo-Hoo Club in Portland is working to make Oregon the 11th state, but I feel that we can beat them to the punch. Let's make Colorado the 11th state to throw off these unfair insurance shackles!"

Should these proposals succeed in any substantial number of our states, it seems to me inevitable that a recurrence of the fire and conflagration hazard of wood shingle roofs would take place. We do not believe that anyone in the fire insurance business would like to see this happen.

Furthermore, the elimination of the rate penalties for wood shingle roofs would lead to attempts to secure the repeal of local ordinances banning the use of wood shingle roofs. We do not believe that any fire chief or fire marshal would like to see this happen.

The warning is plain for all to see. We hope that it will be heeded.

Meeting of Board of Directors

Union League Club, New York, January 23, 1958

Members Present

Richard E. Vernor, Chairman
John A. Neale, President
Henry G. Thomas, Vice-President
Loren S. Bush, Vice-President
Allen L. Cobb, Past President
T. Seddon Duke, Past President

Dale K. Auck	A. Leslie Ham
Warren J. Baker	J. Sharp Queener
Malcolm S. Blake	Elmer F. Reske
Charles H. Bunn, Jr.	George J. Richardson
E. Kenneth Clark	Udell C. Young
Marshall B. Dalton	

Percy Bugbee, General Manager; Horatio Bond, Chief Engineer; Charles S. Morgan, Assistant General Manager; George H. Tryon, Assistant Technical Secretary; Merwin M. Brandon, Chairman, Electrical Section; Robert C. Byrus, Chairman, Committee on Rural Fire Protection; A. L. Brown.

Business Transacted

1. Preliminary plans for the 62nd annual meeting to be held at the Palmer House, Chicago, May 19–23, 1958, as reported by Messrs. Bugbee, Morgan and Reske, were approved.

The Board accepted tentative arrangements for annual meeting sites through 1963 as reported by Mr. Bugbee. The cities selected are: 1959, Atlantic City; 1960, Montreal; 1961, Detroit; 1962, Philadelphia; 1963, San Francisco.

2. In the absence of Treasurer Hovey T. Freeman, his report on the current financial status of the Association was presented by Mr. Bugbee. The report, which was accepted, anticipated a balanced budget for the fiscal year and the largest total financial operation in our history.

Staff Activities

3. a. Current and recent changes in staff personnel were reported by Mr. Bugbee. The Board unanimously expressed its best wishes for a speedy recovery of health to Mr. and Mrs. Robert S. Moulton and extended congratulations to George Tryon on the national award recently received by him.

b. Mr. Bugbee reported that membership stood at 17,039, which is approximately the same level as on May 1. He noted that in view of the increase in dues which went into effect on June 1, 1957 the situation should be regarded as satisfactory. He referred to the continued invaluable services of Mr. H. E. C. Rainey in membership promotion. He also described recent special membership campaigns directed to such groups as the American Institute of Architects, Canadian manufacturers, insurance brokers and agents, and rating bureau engineers.

c. Mr. Bugbee reported on the recent financial campaign conducted under the auspices of a Sponsors Committee headed by Mr. A. R. Fisher, Board Chairman and President of Johns-Manville Corporation. He stated that the current business downturn had had an adverse effect on the number and amount of new contributions but that renewals from regular contributors were apparently unaffected. Mr. Bugbee spoke also of the special financial appeal made to the chemical industry with the cooperation of the Manufacturing Chemists Association. Mr. Queener expressed his optimism that these efforts would ultimately prove fruitful.

d. Mr. Tryon reported on the publishing activities of the Association. He stated that during 1957 the Association issued 111 new publications and published over 8½ million pieces of literature. Approximately 42,000 orders and requests for publications were received, an increase of 2,000 over the previous year and an all-time high.

Specific reference to various publications such as the National Fire Codes was also made by Mr. Tryon.

e. Mr. Morgan reported on advertising in the Association's publications, stating that income from this source to date represented about 76 per cent of the estimate for the year. Satisfactory growth in all respects was reported.

f. The public relations activities of the Association were described by Mr. Bugbee, with emphasis on the Sparky program. He also reported on the annual Fire Prevention Week Contest.

g. Mr. Bond reported on current and proposed activities of the Fire Services Department, referring particularly to the related work of several technical committees. He spoke of the continuing success of *Firemen* magazine in maintaining contact with fire departments and some 33,000 readers. He called attention to the newly organized Committee on Fire Department Organization. Mr. Thomas, Chairman of that committee, then made some observations about its work and objectives.

h. The activities of the Fire Record Department were described by Mr. Tryon. He mentioned completion of analysis of 9,000 fires and the publication of an ever-growing variety of occupancy fire records. President Neale called attention to the remarkable degree of harmony between fire loss estimates prepared by different methods by the NFPA and NBFU.

i. Mr. Brandon, Chairman of the Electrical Field Service Committee, described the extensive developments affecting the Electrical Field Service. He called attention to the revision of responsibilities of the Electrical Field Engineer and expressed his conviction as to the soundness thereof.

j. Mr. Bunn, Chairman of the Flammable Liquids Field Service Committee, discussed the activities of the Flammable Liquids Field Engineer which he described as most successful.

k. Mr. Baker, a member of the Gases Field Service Committee, discussed the work of the Gases Field Engineer and the growing recognition of the value of his services to fire safety and to the industries affected.

l. Mr. Tryon reported developments in the preparation of the Twelfth Edition of the Handbook of Fire Protection, to be available early in 1959. He commented on the invaluable services of Mr. A. L. Brown in this connection.

m. Mr. Tryon described efforts to develop financial support to permit the establishment of an Aviation Field Service project by NFPA.

n. Mr. Byrus, Chairman of the Committee on Rural Fire Protection, informed the Board of the scope of that committee's current program. He emphasized the need for a full-time engineer to implement the broad program and offered his cooperation in developing the financial support necessary to establish a Rural Fire Protection Field Service project.

o. Mr. Bond described the need and desirability of a full-time staff engineer to operate in the field of building construction.

Activities of NFPA Sections

4. a. Mr. Morgan, as Executive Secretary of the Fire Marshals' Section, reported on the recent activities of the Section, mentioning the services rendered by the Association to this group and the helpfulness of this Section to the Association.

b. Mr. Brandon reported on developments in the Electrical Section and indicated that work on the revision of the National Electrical Code was proceeding.

c. Mr. Reske reported on developments in the Society of Fire Protection Engineers. He described potential problems associated with recommendation of consultants and reported the conclusions

of the Executive Committee of the Society.

Meeting at Richmond

5. Mr. Bugbee reported on the successful Fall Conference at Richmond. He described also preliminary plans for holding the 1958 Fall Conference at Pittsburgh and the consideration of Des Moines for 1959. These arrangements were given unanimous approval.

Industrial Committee Report

6. In behalf of the Industrial Committee, Mr. Cobb reported on the conference at Skytop sponsored by the committee to encourage mutual understanding and coordination of efforts in industrial security by diverse groups and organizations.

Technical Advisory Committee Report

7. The report of the Technical Advisory Committee was presented by its Chairman, T. S. Duke. The committee's report was acted on as follows:

a. Unanimously approved recommendation that the Committee on Signaling Systems and Thermostats consider the advisability of preparing a section in NFPA No. 72 to apply to other than electrically operated fire alarm systems and that the manufacturers of gas-operated alarm systems provide the Committee on Signaling Systems and Thermostats with information as to why their equipment should not conform to the full intent of the existing recommendations in NFPA No. 72.

b. Noted and referred to the Committee on Classification of Materials for consideration and report, a proposed change in the name of the Committee to "Committee on Fire Hazards of Materials" and in the scope statement so as to read: "Develop methods for evaluating the fire and related hazards of materials. This committee cooperates with other NFPA committees concerned."

c. Adopted recommendation that scope statement of Committee on Laws and Ordinances be revised so as to read: "Review and advise the Association and the Board of Directors concerning the merit and suitability of suggested laws or ordinances originating within the NFPA."

d. Adopted amended recommendation that scope statement of Committee on Flammable Liquids be revised so as to read: "To develop safeguards for the storage, transportation, handling and use of flammable liquids. This Committee consults with other NFPA committees where jurisdiction may overlap."

Mr. Duke reported an industry request for further consideration of pallet design. The Board approved a recommendation that the subject be referred to a conference committee composed of representatives of the NFPA committees concerned under the leadership of the Committee on General Storage.

Mr. Duke adjured technical committees to seek more diligently to resolve technical questions and disagreements arising in course of their deliberations and to avoid so far as possible reference of such matters to the Board. This expression had the support of the Board.

Committee Appointments

8. Proposed appointments to committees were confirmed in accordance with the list submitted with the agenda of the meeting. A supplementary list of proposed appointments was noted and action thereon deferred to a later date.

Other Business

9. Mr. Queener commended the Safety Good Turn program of the Boy Scouts of America, and urged NFPA cooperation. Mr. Bugbee stated that an offer of cooperation had already been extended to the Boy Scouts and that this had been accepted.

10. Mr. Auck raised certain questions about the NFPA Retirement Pension Plan which were referred to the Advisory Committee.

11. Mr. Queener mentioned the growing problem of teen-age rocketry and complimented the recent statement on this subject prepared and released to the press by the staff.

Large Loss Fires of 1957 — Summary

An NFPA Fire Record Department Study

During 1957 there were 422 fires and explosions in the United States and Canada causing losses of at least $250,000 each. Of these, 77 involved losses of $1,000,000 or more. The total loss resulting from the 422 fires was $349,915,500. The 1957 loss exceeded by $20,000,000 the total of the large loss fires of 1956, the previous high year. The number of large loss fires in 1957 was eight less than the record 430 in 1956. Excluding aircraft fires, 360 large loss fires caused $242,750,500 loss in 1957. Corresponding figures for 1956 were 343 fires and $207,326,000.

In the 422 large loss fires in 1957 there were 312 deaths (includes 222 aircraft fire fatalities) and 856 nonfatal injuries (aircraft nonfatal injuries not included).

The 422 large losses represented about 0.02 per cent of the total number of fires last year but caused approximately 25 per cent of the total dollar loss. Because of the effect of the few "large loss" fires on the annual total fire waste and also because of the many inevitable indirect losses resulting from such fires that cannot be measured in dollars, they have been carefully analyzed each year by the Fire Record Department of the NFPA and the results published in the QUARTERLY.

In order to present the results of this study in a useful form the fires have been grouped into eight classifications (see Table of Contents). Except for the aircraft fires a discussion of the significant factors responsible for the fire experience in each classification has been presented and individual fire reports have been included for all fires with losses of $500,000 or more. At the end of each of the classifications the fires with losses from $250,000 to $500,000 are listed. A list is presented on pages 289 and 293 of large loss aircraft fires.

We are indebted to city, state and provincial fire officials, insurance organizations and individual members for the reports that form the basis of this study.

No. of Large Loss Fires by Years

	1957	1956	1955	1954	1953
Manufacturing	125	117	78	75	105
Storage	55	50	41	54	48
Mercantile	58	53	50	54	29
Transportation	66	92	70	57	39
Residential	17	24	9	11	11
Miscellaneous	101	94	68	62	61
Totals	422	430	316	313	293

Geographical Distribution

Three hundred and two of the large loss fires occurred in the United States, 38 in Canada. States with the greatest numbers were New York with 30, California 24, New Jersey 23, Pennsylvania 22, Ohio 21, Illinois and Michigan 16 each. In Canada, the Province of Ontario had 15 large loss fires, Quebec 11. Transportation and forest fires are not in this geographical summary.

Construction Features

Past studies of fires have shown that large losses usually can be prevented by structurally limiting the area through which a fire may spread. Construction weaknesses have always played a prominent role in the large loss fire experience and the 1957 experience was no exception. Of the 327 fires that occurred in buildings, structural fire protection weaknesses played a significant part in the extent of damage in 284 instances. In these 284 building fires one or more of the substandard fire protection features of the buildings enumerated below contributed to fire spread.

Division walls are a major structural device for limiting fires. Absence of a division wall (instances where good judgment would have recommended subdivision) was noted in 214 fires.

There were 17 sub-standard division walls (e.g. did not extend through roof, low fire-resistance rating, etc.), 13 unprotected doorways in division walls, and 5 fire doors blocked open.

In the 218 buildings of more than one story (including 28 one-story buildings with basement) fire spread beyond the story of origin in 187 cases because of 93 open stairwells, 48 non-firestopped walls, 33 open elevator shafts, 18 substandard stairwell enclosures, and 11 substandard elevator enclosures.

Other frequently recorded structural features contributing to the extent of fires were combustible fibreboard (21), other combustible interior finish (23) and oily floors and walls (14).

Eighty-seven fires spread from the building of origin to exposed buildings for one or more of the following reasons: 46 cases of combustible buildings without intervening fire walls, outside sprinkler protection or adequate separation of buildings; 18 cases of poorly constructed party walls; 10 interconnecting passageways; 9 explosions; 9 ordinary glass windows; and 9 yard storage.

Sprinkler Protection

Twenty-seven complete sprinkler systems and 9 partial systems were installed in the 327 buildings involved in large loss fires in 1957. These figures agree closely with those of 1956 when 30 complete and 9 partial systems were involved. To anyone not familiar with the excellent record of sprinkler systems the fact that 36 large loss fires occurred in sprinklered buildings in 1957 might be cause for doubt as to the effectiveness of this protection. While reviewing the unsatisfactory sprinkler performance concentrated in these large loss fires one should keep in mind the fact that in a recent study of sprinkler performance*, sprinklers performed satisfactorily in 96.2 per cent of 58,971 fires studied. From this study and also from a review of the sprinkler performance in the 1957 large loss fires it will be clear that a sprinkler system, to perform satisfactorily under all fire conditions, must be designed to protect against the hazards in the area where it is installed, must be installed properly and must be maintained in operating condition at all times.

On the 27 complete sprinkler systems, 1 that was installed in an industrial plant was not a factor in the outcome of the fire (originated on and was confined to roof covering) and in 4 cases (all industrial plants) the systems performed satisfactorily.

Closed sprinkler valves were responsible for unsatisfactory sprinkler performance in 7 fires involving complete systems. Three unsupervised valves were closed for undetermined reasons at the time of the fire (2 industrial plants, 1 building under construction), 2 were closed before the fires were out (2 industrial plants), 1 was closed until a fused sprinkler could be replaced that had put out a fire two hours earlier (industrial plant) and 1 valve had been closed and the system drained to prevent freezing (warehouse). At 4 fires involving completely sprinklered buildings performance was not satisfactory because the hazards of occupancy were too severe for the systems as installed (all industrial plants) and in 3 instances poor water supplies prevented proper sprinkler performance (1 industrial plant, 2 warehouses). Three sprinkler systems were damaged by explosions in industrial plants. In 2 warehouse fires improper storage methods prevented sprinkler discharge from reaching the fire and in an industrial plant the fire spread within wall and ceiling spaces out of range of sprinklers. A failure of a fire pump was responsible for unsatisfactory sprinkler performance at 1 industrial plant and at another, fire spread over the outside of a sprinklered wooden building.

*Automatic Sprinkler Tables — 1955 (Q48-12); Published by the National Fire Protection Association. Price 25 cents.

One of the 9 partial sprinkler systems was not a factor (fire in upper stories of industrial building with sprinklers in the basement only), and 1 partial system performed satisfactorily in an industrial plant. Of the 7 unsatisfactory operations 6 were due to the fact that fires originating in unsprinklered areas reached such intensity before entering the sprinklered areas that sprinklers were overpowered, (3 industrial plants, 2 residential occupancies, 1 warehouse). Poor maintenance of deluge valves prevented deluge systems from operating at an industrial plant.

Fire Detection and Alarm

Provision of means for prompt fire detection is a vital part of a program to prevent large loss fires. Last year discovery of the fire was delayed in 217 building fires. In most of these (141) delay occurred because the buildings were not in operation and had been left without watchman or automatic fire protection during nonoperating periods. There were 28 instances where substandard watchman protection was responsible for delayed discovery.

Only 5 properties were protected by automatic fire detection systems, of which 3 were central-station-supervised. Three systems detected the fires and transmitted the alarms (2 industrial plants, 1 warehouse) but because of the combustibility of the contents, origin in concealed ceiling spaces, improper storage methods and lack of sprinklers the fires had spread beyond control by the time fire fighters arrived. In one industrial plant an electro-mechanical system had not been rewound after a test. Improper installation caused failure of gas-operated alarms in another plant.

In the 110 instances where building fires were discovered reasonably promptly the great advantage gained by prompt detection so that professional fire fighters could get into action while the fire was small was lost at 73 fires because alarm transmission was delayed. The chief offenders were occupants (23 instances) who chose to try to put out the fire without professional help and only called the fire department after the fire had gotten out of control. Other recurring reasons for delayed alarm were 8 burned telephone wires, 5 telephones inaccessible, 2 cases of bystanders neglecting to transmit the alarm, 2 in which watchmen fought the fire before transmitting the alarm.

Extinguishers, Standpipes, Brigades

Most large loss fires were beyond the capabilities of extinguishers and small hose streams when discovered. Fire extinguishers were used in 55 cases. In 53 cases extinguisher performance was not satisfactory for one or more of the following reasons: fire too far advanced on discovery 25, inadequate number of units 14, wrong type 12.

There were 20 fires where losses would probably have been considerably less had standpipe hoses been available. Employees made effective use of standpipe hoses at 10 fires. At 18 others standpipe hoses were ineffective.

Twenty-four private fire brigades performed their duties satisfactorily, but in 5 cases they could not do so because the fire was too far advanced at time of discovery, in 3 cases because of insufficient equipment, and in 3 cases because the brigades were poorly trained. At 37 fires the absence of a well-trained and equipped fire brigade was a notable weakness in private fire protection.

Fire Causes

In 49 per cent of the 326 building fires, known or probable causes were reported.

Of the 161 known or probable causes there were 28 attributed to wiring faults, (20 in 1956). Incendiary or suspicious fires were reported 19 times (21 in 1956, 5 in 1955). Misuse of flammable liquids accounted for 14 fires, careless cutting and welding practices 13, defective electrical appliances 11, misuse of fuel gas 10, friction 10, careless smoking 8.

The 125 Largest Industrial Fires in 1957

The 125 manufacturing plant fires in 1957 with losses of $250,000 or more were eight more than in 1956 and 47 more than in 1955. Not only has the number of large loss industrial fires increased alarmingly during recent years but so has the dollar loss: $94,702,000 in 1957, $69,635,000 in 1956, $76,578,000 in 1955 and $36,144,500 in 1954. It is this broad industrial occupancy class that is primarily responsible for the steady increase in United States and Canadian fire losses during recent years.

Note also should be taken of the unfavorable trend in fire casualties resulting from these large fires and explosions. There were 54 deaths in 1957, 37 in 1956, 22 in 1955 and 19 in 1954. Nonfatal injuries in 1957 were 280 (151 fire fighters, 129 employees and others) as compared with 197 (129 firemen, 68 employees and others) in 1956.

54 Per Cent Discovered Promptly

Contrary to the large loss experience in other occupancies, the majority (54 per cent) of the largest industrial fires were discovered without appreciable delay. Primarily responsible for this unusual detection record in industrial plants is the fact that 66 (53 per cent) of the fires occurred during operating periods, when employees were in the buildings. Forty-eight of the fires were discovered promptly by employees. Although the fire detection experience of 1957 does not agree with that of 1956 when only 42 per cent occurred while the plants were working, it does agree well with the experience of other recent years (52 per cent in 1955, for example).

What about the 46 per cent of industrial fires that were not discovered promptly? In 40 cases delayed discovery was due to lack of automatic protection or a watchman; in 10 cases substandard watchman protection was responsible for the delay and in the eight others various reasons were responsible, including one instance where an automatic fire detection system did not give the alarm.

All Building Types

Eleven of the large loss industrial fires did not occur in buildings. The 114 buildings in which industrial fires occurred were made up of 40 of brick, wood-joisted construction; 20 all wood; 17 noncombustible; 12 wood-framed metalclad; 3 fire-resistive; and 22 of miscellaneous other types or of mixed construction.

More significant than the basic structural building types are certain structural fire safety weaknesses that were noted as contributing to the extent of damage in buildings of all types ranging from wood to fire-resistive. Excessively large areas that should have been subdivided by division walls influenced the amount of damage in 68 fires, open stairwells in 24, open elevator shafts in 7 and unprotected openings in division walls in 5. Substandard structural methods of restricting fire-spread proved to be no better than complete absence of such protection in several industrial plant fires, including seven instances of fires spreading out of the area of origin because of substandard protection of division wall openings, and ten cases in which fire spread to another story because of substandard enclosures for stairs and elevator shafts. Combustible fibreboard and other combustible interior finish spread flames in six cases.

Flammable Liquids, Dusts and Gases

In 49 fires flammable liquids escaping from containers, pipelines or processing equipment contributed to the intensity and extent of damage. There were 10 similar cases involving flammable gases. Combustible dusts influenced rate of flame-spread in 24 fires.

Other contents features frequently mentioned as having a bearing on the

outcome of many of these 125 industrial fires were improper storage methods (21 instances of poor stock subdivision, high piles, inadequate window clearance); eleven cases of rubbish accumulation and other housekeeping problems.

Twenty-six Sprinkler Systems

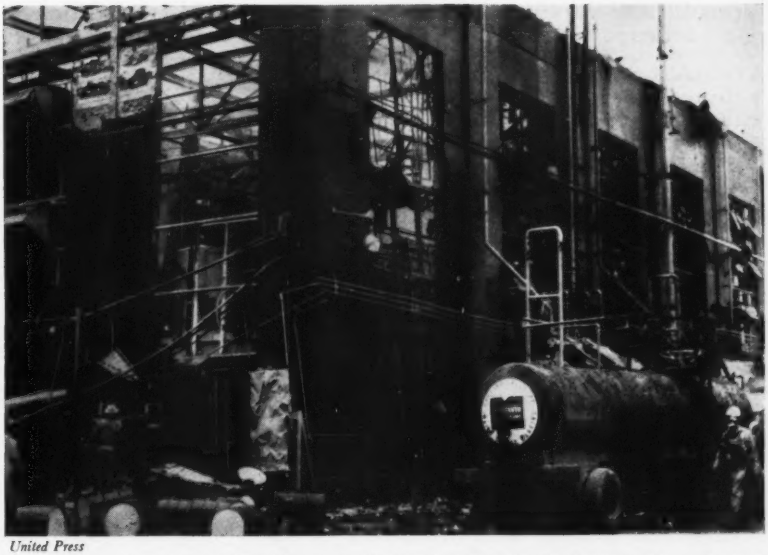
Eighty-eight of the 114 buildings in which large loss industrial fires occurred were not sprinklered. Twenty buildings had complete sprinkler protection and six had partial systems. A review of the performance of these 26 systems confirms the findings of other sprinkler performance studies, namely, that in order for a sprinkler system to extinguish or control all fires it must be properly designed for the hazard to be protected, must be properly installed and must be maintained in operating condition.

One of the 20 complete systems was not a factor in the outcome of the fire (printing plant, Kokomo, Ind.) since the fire originated on and was confined to the roof. In four fires the sprinklers performed satisfactorily to extinguish or hold the fires in check until put out by hose streams (feed mill, Oakland, Calif.; metalworker, Toronto, Ont.; drug manufacturer, Linden, N. J.; metalworker, Ionia, Mich.). Large losses in these cases resulted from explosions or water damage.

Performances of the other 15 complete systems were unsatisfactory. In four instances hazards in the areas being protected were too severe for the sprinkler systems as installed (fibre pipe factory, Orangeburg, N. Y.; artificial flower factory, New York, N. Y.; paper working plant, Rockland, Del ; paint and varnish factory, Chicago, Ill.). Three of the systems were damaged by explosions and consequently were unable to control the ensuing fires (glass working plant, Scarborough, Ont.; chemical works, Nitro, W. Va.; plastics manufacturing plant, Pittsfield, Mass.). In two fires (paper working plant, Lockland, Ohio; metalworker, Mt. Pleasant, Wis.) un-

Daniel Behnke

During the bagging of protein a dust explosion occurred at this chemical plant at Chicago, Ill. **(See report, page 231.)**



United Press

Eight employees were killed by an explosion of a glass-lined chlorinator in a chemical plant at Nitro, W. Va. (See report, page 230.)

supervised sprinkler valves were closed when the fire broke out and in two other cases valves were closed before the fires were out (rubber reclaiming plant, Butler, N. J.; cotton batt factory, Detroit, Mich.). Sprinklers failed to perform satisfactorily at a Portland, Ore. sawmill because of poor water supplies, failed in another fire because of a fire pump failure (feed mill, Ste. Madeleine, Que.) and in another because an exposure fire ignited the outside of a sprinklered wooden sawmill at Kennydale, Wash. In a textile mill at Skuylkill Haven, Pa. fire spread through concealed wall and ceiling spaces out of range of sprinklers.

One of the six partial sprinkler systems was not a factor in the outcome because the fire did not start in or spread to the sprinklered basement (textile plant, Los Angeles, Calif.). The partial system in a leather working plant at Berwick, Maine held a fire in check which originated in an unsprinklered spray booth and spread through unsprinklered exhaust ducts. Three of the partial systems were overpowered by fires that originated in communicating unsprinklered areas (sawmill, Giscombe, B. C.; paper mill, Corner Brook, Nfld.; metalworking plant, Sacramento, Calif.). At a metalworking plant at Cleveland, Ohio deluge sprinklers in a large enclosure for painting and drying operations failed to operate because deluge valves had not been maintained in operating condition (drain lines plugged with stones and scale).

Four Automatic Fire Alarms

A central-station-supervised rate-of-rise type automatic detection system was installed in the New Haven, Conn. textile factory where 15 persons lost their lives. An alarm from the automatic system was received at the fire department at about the same time that a telephoned alarm was received. (For detailed report of this fire see the February, 1957 NFPA Fire News.)

Firemen answering an alarm transmitted by a central-station-supervised rate-of-rise type detection system in

Modesto, Calif. found a feed mill fully involved in flames.

A combination fixed temperature and rate-of-rise system was installed in a woodworking plant at Neenah, Wis. The system, maintained by plant personnel, failed to operate because someone neglected to rewind the electro mechanical transmitter after a system test.

In a stone crushing plant at West Orange, N. J. two gas-pressurized type fire alarm units were suspended beneath the peaked roof of a 40- to 50-ft.-high partly open-sided building. Fire that originated at floor level was discovered without serious delay by employees, but the flames extended to a grease-covered conveyor and spread along the conveyor before a strong wind to three interconnected buildings. Sufficient heat did not accumulate beneath the roof to operate the alarm units until after the fire department was on the scene.

Thirty-one Watchmen

Thirty-one of the 125 industrial properties suffering large loss fires last year were protected by watchmen. In seven of these cases the watchman protection was not a factor (fires detected promptly and alarms transmitted by some other means). Six watchmen did what they were expected to do — discovered the fire promptly and sent the alarm at once but because of the speed with which the fires developed, the fires were out of control when fire apparatus arrived.

The remaining 18 watchmen (60 per cent) did not perform their duties satisfactorily, either because they did not discover the fires before they had spread beyond control or because they failed to transmit the alarm properly. In one instance, for example, the watchman was unable to use the telephone to give the alarm because of a speech difficulty.

Brigades, Extinguishers, Standpipes

Twenty-nine of the 125 industrial plants had private fire brigades. In four of these the fire brigades were not needed. In 20 the brigades performed satisfactorily and in five instances they did not, due to poor training and insufficient equipment.

Portable fire extinguishers were used at 30 fires. In 2 cases they were used successfully to assist in fire control. In the other 28 fires their use was not satisfactory because the fires were too far advanced on discovery, the wrong class extinguisher was used or because the extinguisher was used improperly.

Standpipe hoses were used in 17 fires. In seven cases they were used successfully either alone or in conjunction with other fire fighting equipment to control the fires, but in the remaining ten fires standpipe hose performance was not satisfactory for a variety of reasons.

Chemical Plants

April 16, Nitro, W. Va., Monsanto Chemical Co. $5,000,000†; 8 killed

Methyl parathion. During the batch chlorination step in the manufacture of methyl parathion an explosion blew the cover of the glass-lined chlorinator in the second story through the roof of the 3-story brick, steel-framed building, drove the vessel itself down into the floor and released flammable gases that ignited and fatally burned eight employees. The building, including its sprinkler system, was extensively damaged and windows within a radius of 1,000 ft. from the explosion were broken. The ensuing fire was extinguished quickly with four 2½-inch hose streams.

Because of the threat of toxic fumes residents of nearby homes were evacuated and road blocks were set up to prevent unauthorized persons from entering the danger area. This emergency action was effectively carried out by activating an emergency plan that had been developed by the Kanawha Valley Industrial Emergency Planning Council.

Failure of a thermocouple in the chlorinator was responsible for the explosion. When temperatures rose to a predetermined level in the chlorinator as measured by the thermocouple, the chlorine feed was shut off automatically and brine circulation was started.

†Figure includes business interruption loss.

With the thermocouple not functioning the batch in the chlorinator continued to heat up and when it became hot enough decomposed instantaneously.

July 5, Chicago, Ill., The Glidden Co. $698,000†

Filtering, drying, grinding, bagging, storage of protein. During the bagging of protein, a by-product of soybean oil extraction, a dust explosion occurred in the top story of the unsprinklered 4-story section of a 2- and 4-story masonry, steel-framed building. Cause of the explosion is unknown. One employee was seriously injured, part of the roof was destroyed and the fourth and third stories were badly damaged by the explosion and ensuing fire that involved bagged protein.

Sept. 12, Kobuta, Pa., Koppers Co., Inc. $1,000,000

Wide World

Styrene. Rupture of a corroded 6-inch pipe carrying a mixture of benzene (flashpoint 12°F) and ethyl benzene (flashpoint 59°F) at elevated temperature and pressure was followed by an intense flammable liquid fire that severely damaged processing equipment at the ethyl benzene area of the plant. Apparently a large part of the credit for preventing spread to other areas of the plant and for the control of the fire three hours after its start should go to the plant's fire brigade. However, information on the performance of the fire brigade and on the important fire protection lessons of the fire has not as yet been released.

A $500,000 fire occurred at this same plant on March 6, 1951. The lessons of this fire were very ably presented at the NFPA Annual Meeting at Detroit that year by three employees of the Koppers Company. Their report was published in the July 1951 NFPA *Quarterly*.

Nov. 16, Barberton, Ohio, Columbia-Southern Chemical Corp. $1,000,000†

Hydrogen peroxide. An explosion in hydrogen peroxide concentrating equipment wrecked the heavy aluminum equipment and started several fires in other equipment.

Further details have not been released.

Electric Generating Plant

Oct. 11, Stamps, Ark., Arkansas Power and Light Co. $650,000

Steam-powered electric generating plant. A gas explosion occurred in a boiler while it was operating at reduced load. At the time, a turbine overspeed governor test was being run on the associated turbo-generator. Of the 18 gas burners, only three were in operation. Following the explosion a break in a tube was discovered in the saturated steam wall of the lower header. It is felt that this break occurred before the explosion and caused extinguishment of the burners for a brief period. During this time gas escaped into the boiler where it formed an explosive mixture.

Food and Food Products

Animal Feeds

Jan. 19, Ste. Madeleine, P.Q., Antoine Guertin Ltd. $558,500

Grist mill and warehouse. Fire that destroyed this sprinklered 32,760 sq. ft. 3-story wooden building originated about half way up in a wooden soy meal bin. Spontaneous heating of the meal was the probable cause. On discovering the fire, employees discharged several extinguishers and then brought in two hoses. Fifteen sprinklers above the bins were by then operating and in combination with the two hose streams were holding the fire in check as employees removed some of the meal from the bin in an effort to get at

†Figure includes business interruption loss.

the fire. Two fire departments responded and also placed some hose streams in operation.

Water for fire control was supplied by a 1,000 gpm gasoline-driven fire pump in a wooden shed adjoining the building. The fallacy of locating this pump where it would be vulnerable to fire in the building it was protecting was demonstrated five hours after the fire started. The pump operated satisfactorily for five hours before it became drenched with water from a fire department hose stream and stopped. With no water thereafter available for sprinklers and hose streams the fire spread throughout the building.

June 17, Modesto, Calif., J. S. West Co. $542,000†

Feed mill and ice factory. At 2:41 A.M. the fire department received an alarm from the central-station-connected rate-of-rise type automatic fire alarm system installed in the unsprinklered 20,000 sq. ft. 1-story wood-framed, metalclad building. Although the fire station was only a few blocks from the building and firemen responded promptly, the building was well involved when they arrived. The statement in the fire chief's report that an attendant at a service station 100 feet from the fire saw flames coming from the roof before the automatic alarm was transmitted suggests that the alarm system may not have operated promptly. The service station attendant, of course, would have no way of knowing exactly when the alarm was transmitted and it is therefore possible that when he saw the flames the automatic alarm system had already operated.

The fire originated in an area where work with cutting and welding torches had been done up until 9:30 P.M. the previous evening. There was a 3-ft.-deep concealed space beneath the flooring in this area which was not protected by the automatic alarm system. Had welding sparks fallen through floor cracks and started a fire in the concealed subfloor space, it is conceivable that fire could develop to serious proportions in the concealed space before burning through the flooring, operating the alarm system and spreading rapidly through the dusty building.

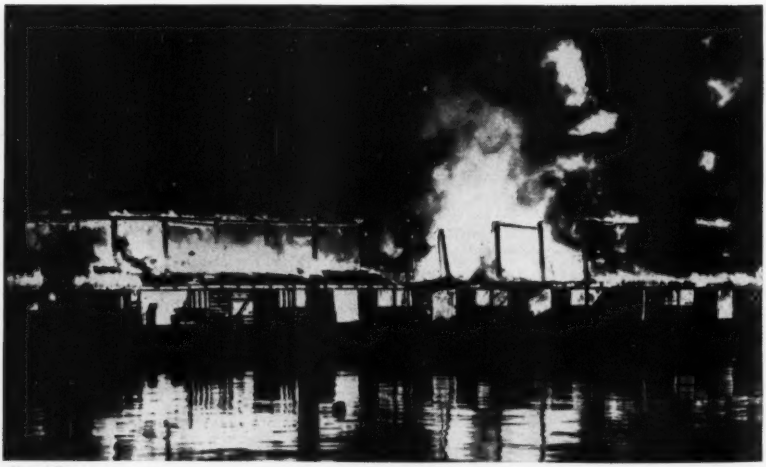
†Figure includes business interruption loss.

Fruit Packing

*March 9, Summerland, B. C., Summerland Cooperative Growers Assn. $720,000

Fruit packing plant; cold storage warehouse. Originating in a packing room in the first story, fire of undetermined cause

*Fire spread to other buildings.



United Press

This unsprinklered fish cannery at Anacortes, Wash. was destroyed by fire during the off season. Due to the absence of private fire protection the fire had broken through the roof before discovery.

San Jose Mercury

This $275,000 fire broke out in an infrared oven where aluminum garage doors were being dried in this metalworking plant near San Jose, Calif. In the absence of sprinkler protection and division walls the fire spread rapidly through the 200 ft. by 100 ft. 2-story building.

spread throughout the 30,000 sq. ft. undivided 2-story masonry, wood-joisted building and had broken through the roof by the time firemen answered a passerby's alarm at 12:40 A.M. The fire occurred during the off-season when 125,000 empty apple crates were stored in the building. There was no watchman or sprinkler protection.

Firemen set out to save a 25,600 sq. ft. 4-story cold storage warehouse 40 feet away, but intense heat prevented their getting close enough to use hose streams effectively.

Glass Works

Dec. 5, Scarborough, Ont., Canadian Thermos Products Ltd. $1,625,000; 1 killed

Thermos bottle assembling. At 7:31 P.M., while the night shift was at work, a severe explosion occurred that blew out three walls of the 300 ft. by 275 ft. 1-story masonry-walled building. One woman employee who was in the ladies' washroom in the basement when the explosion occurred suffered injuries that resulted in her death on December 26. Damage to the sprinkler system by the explosion prevented its operation when a severe fire developed involving cardboard cartons, plastic cups, solvents and other combustible materials in the building.

It is generally agreed by investigators that the explosion involved propane gas. Propane was used in the plant operations and was piped into the building from four 1,750-gallon storage tanks about 20 feet away. Apparently gas escaped from a leak in the outdoor storage facilities or associated piping and spread into the basement where the explosion is believed to have originated. The place where the leak occurred has not as yet been determined.

For several hours preceding the explosion employees had smelled propane and during the afternoon a leak was found at a regulator at one of the tanks and the regulator was replaced at 5:00 P.M. The night shift employees were warned about the presence of propane.

Metalworking

Aircraft Assembly

Aug. 25, near Bethany, Okla., Aero Design and Engineering Co. $2,300,000

Assembly of twin-engine Aero Commander aircraft. Lack of automatic protection or supervised watchman service allowed fire to spread beyond control in this 33,800 sq. ft. 1-story steel-framed, metalclad building before discovery. A night man stayed at the

Stanley L. Payne

No watchman or automatic fire protection was provided for this steel forging plant located beyond the city limits of Colorado Springs, Colo. Consequently, fire that broke out after employees had gone home was well on the way toward causing $350,000 loss before discovery by a neighbor.

building but there was no way of checking his actions. On discovering the fire at 4:57 A.M. the night man telephoned the alarm but the fire had already made considerable headway and had started to spread through the combustible contents and interior finish including large wooden parts bins, a wooden balcony, wooden partitions, oil and paint in drums and upholstery.

With flames coming from the roof when fire departments arrived, fire fighting was concentrated on saving exposed buildings. Despite the poor water supply from a dead-end 8-inch main the fire was confined to the building of origin.

Electrical Appliances, Equipment

Nov. 15, Los Angeles, Calif., U. S. Relay Co. $850,000

Electrical relays for military use. Five hours after this plant had been locked up for the night and left without automatic or watchman protection, a passerby discovered fire and notified the fire department. The rear of the second story of the unsprinklered 11,700 sq. ft. 2-story combustible building was in flames and due to the lack of subdivisions and the presence of plywood interior finish fire spread through the entire second story before being controlled. Among the contents destroyed was expensive electronic testing equipment.

The fire originated in the flooring beneath a degreasing tank. Investigators believe the three electric heating elements beneath the tank had been left on by mistake.

Dec. 2, Keansburg, N. J., Hermetics, Inc. $1,000,000†

Hermetic seals for electronic tubes. Lack of automatic fire protection and a trained private fire brigade were primarily responsible for the destruction of this unsprinklered 15,000 sq. ft. 2-story masonry, wood-joisted building. Open stairways, concealed wall spaces and a poorly manned public fire department were also factors, but the effects of these weaknesses would not have been felt had strong private protection been available.

The fire broke out in oil drippings on the first floor when more than 100 employees were in the building. Had the building

†Figure includes business interruption loss.

been sprinklered or had a group of employees trained and equipped to fight fires been available, the fire in all probability would have been confined to the area of origin. Instead, the fire spread to other combustible contents in the first story and was too big to be controlled by the poorly manned fire department when it arrived.

***Dec. 4, Greenville, Ohio, Hobart Manufacturing Co., et al. $657,500**

Dish washing machine assembly; repair garage; beer distributor; 4-apartment building. At 8:30 P.M. the night watchman, while on one of his supervised hourly rounds, looked up and saw a cloud of black smoke at the front end of the first story of the unsprinklered 226 ft. by 74 ft. 2-story brick, wood-joisted building. He ran to the office to telephone the alarm but because of the smoke and heat, had to go to a service station across the street to notify the fire department. The fire spread so rapidly that most of the undivided building was involved when firemen arrived. Three combustible buildings housing a garage, beer warehouse and apartments were also destroyed. Plain glass windows in exposed walls, combustible walls and lack of adequate clear spaces between buildings made these buildings vulnerable to exposure fires.

Investigators determined that the fire broke out when the oil supply pipe to the oil burner broke near the boiler. The boiler and two oil storage tanks with a total capacity of 3,000 gallons were located in an attached wooden boiler house that communicated with the first story. When oil spilled on the floor and ignited, flames spread rapidly to the main building before discovery.

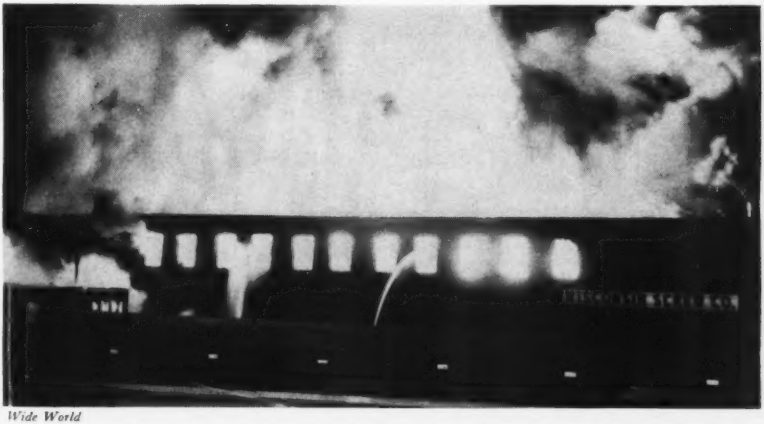
Foundries

***Aug. 6, Northville, Mich., Allied Products Corp. $550,000**

Northville Record

Small metal automotive and appliance parts manufactured from powdered metal (iron, copper, brass, tin). Approximately two hours after a cutting torch had been used on the loading platform above one of the metal powder presses, an employee noticed fire at ceiling level above the loading platform. During the cutting torch operation

*Fire spread to other buildings.



Wide World

Unsupervised valves on sprinkler systems in this machine shop at Mt. Pleasant, Wis. were closed sometime before the fire of suspicious origin occurred. (See report, page 236.)

an employee had stood by with an extinguisher, but apparently sparks fell among paper bags and other combustible material on the loading platform and escaped his notice. The flames spread rapidly over the asphalt-coated combustible fibreboard that covered the walls and ceiling of the unsprinklered 1-story steel-framed, metalclad section of the building.

The alarm was telephoned at once but fire had spread through three large unprotected doorways in a masonry wall and had entered the adjoining masonry, steel-framed section of the 23,300 sq. ft. building before firemen arrived. It was immediately apparent that the fire was beyond the capabilities of the small volunteer fire department (one pumper and one high pressure fog truck) and help from surrounding towns was summoned. The two additional pumpers that responded were of limited assistance because of weak water supplies and a defective hydrant. Firemen were unable to save either of the sections already involved when the first apparatus arrived and could not keep fire out of a third communicating brick, wood-joisted laboratory and office section.

Machine Shop

April 28, Mt. Pleasant, Wis., Wisconsin Screw Co. $1,500,000†

Screws and other metal products. The 26,650 sq. ft. 2-story brick, wood-joisted building was destroyed by a suspicious fire that originated in the first story during the night and was discovered by an outsider 45 minutes after a watchman had checked this building and left to check other buildings under his supervision.

The building was sprinklered but because the unsupervised valve controlling sprinklers in the area where the fire started was closed, flames spread to communicating first story areas and up an open elevator shaft to the second story where the large number of sprinklers that fused overpowered the water supply. Oil-soaked floors and large open tanks of flammable liquids helped create an intense and rapid-spreading fire. Public fire fighting was hampered by poor water supplies in the vicinity of the plant.

†Figure includes business interruption loss.

Steel Fabrication

***Jan. 9, Blue Point, N. Y., Silent Flame Oil Burner Co., et al. $325,000**

Oil burners; wholesale fruit warehouse; plumbing and heating warehouse. Three adjoining buildings, each about 5,000 sq. ft. in area and of combustible construction, were destroyed by fire that originated in the middle one. The building of origin was occupied by the oil burner company and, like the others, had no automatic or watchman protection. Consequently, when fire broke out at night it was not detected until seen by an outsider at 1:12 A.M. The fire

*Fire spread to other buildings.

Wide World

Sparks from an acetylene cutting torch reportedly caused this $399,000 fire in a railroad roundhouse at Milwaukee, Wis. Fire fighting was severely hampered by weak water supplies from the leaking and poorly maintained yard hydrant system.

was then out of control in the 3-story building of origin — (oil-soaked from its former use as a peanut oil factory). Lack of adequate clear spaces between the combustible buildings and poor public water supplies appear to be the principal reasons that fire spread to the exposed combustible buildings.

Jan. 16, Cleveland, Ohio, The Midland Steel Products Co. $555,000†

Auto frames. Fire of unknown cause originated in a long conveyor enclosure in which auto frames were painted by a flow coat process. Flames spread rapidly over paint residue in the enclosure, entered a connecting drying oven and spread to the built-up roof on the steel deck of the adjoining covered craneway.

Investigation to determine why the open head sprinkler systems in the conveyor enclosure and drying oven failed to operate and confine the fire revealed that the ⅜-inch drain lines from the equalizer chambers of two of the four deluge valves were obstructed by small stones and pipe scale, thereby preventing sufficient drop in pressure in the equalizer chambers to trip the deluge valves. Routine tests of the sprinkler systems had not included trip tests of the deluge valves.

*Jan. 23, Tawas City, Mich., Timco Corp., et al. $1,000,000

Furnaces, truck garage. Absence of automatic and watchman protection accounted for an estimated three-hour delay in discovery of fire in the large 1-story brick, wood-joisted furnace manufacturing plant. Fire had involved the interior and was coming from the roof of the building of origin when firemen answered a passerby's alarm at 3:15 A.M., and had spread over a party wall to the roof of the adjoining 1-story truck garage. Fire entered the latter building where fuel in truck tanks assisted spread.

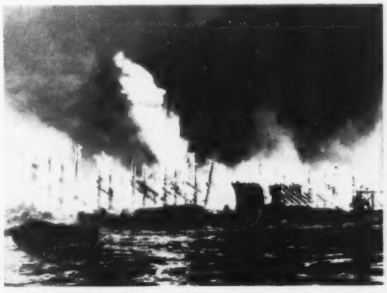
In addition to the loss of its plant, the furnace company lost its records and drawings.

April 3, Winamac, Ind., Winamac Steel Products Company $624,500†

Leaf and coil springs. Leaf springs after being treated in a 1,500°F. furnace were passed through a 5,500 gallon quench tank of oil (flash point above 300°F.). When one of the springs got caught half in and half out of the quench tank the oil ignited. With no special fire extinguishing system installed at the tank, an intense fire developed that spread to the wood roof of the unsprinklered and undivided 23,500 sq. ft. 1-story masonry, wood-joisted building. When gas regulators ruptured on piping to the gas-fired furnace, escaping gas intensified the fire and could not be shut off since shut-off valves were inside the burning building.

Volunteer firemen started arriving about five minutes after the alarm, but with a 4-inch dead-end main the only available water supply, two 2½-inch lines were all that could be placed in operation.

Dec. 29, Baraga, Mich., Pettybone Manufacturing Co., et al. $500,000



L'Anse Sentinel

Gasoline-powered industrial lift trucks, fire station. A fault in wiring to suspended oil-fired furnaces was the probable cause of fire that broke out in the unsprinklered 2-story wooden building (formerly a skating rink) late Sunday afternoon when no one was in the building. The village fire engine was garaged in a partitioned-off corner of the building and the fire siren was on the roof. On discovering the fire at 6:00 P.M. a person living across the street tried to operate the fire siren only to discover that it had been put out of service by the fire. He could not open the door to get to the fire engine and when the door was finally opened the room and engine were a mass of flames.

After a 15-minute delay while unsuccessful efforts were made to get the fire truck out, the L'Anse Fire Department was called. After a ten minute run L'Anse firemen found fire out of control in the building and concentrated on preventing spread to other buildings. Loss to the building and contents, including the fire truck, was total.

*Fire spread to other buildings.

†Figure includes business interruption loss.

Zinc, Lead, Silver Refining

*May 21, Mullan, Idaho, American Smelting and Refining Co. $901,000

Flotation mill at zinc, lead and silver mine. A group of interconnected and unsprinklered 1- to 4-story wooden buildings was destroyed by fire that originated in an electric substation in the first story of the 70,000 sq. ft. 4-story mill building. Examination indicated that the mine feeder oil switch became overloaded, and in attempting to unload automatically, exploded and covered the surrounding walls and floor with flaming oil.

The fire raced along overhead beams, which had become covered with an oily film from the reagent in the flotation machines, and had involved the entire mill building in 15 minutes. Fire spread through unprotected openings to several other buildings including the mill repair shop, ore bins, thickener building and timber shed, but was kept from other exposed buildings by the mill fire brigade and volunteer fire departments.

*Fire spread to other buildings.

Mining

*June 18, Coal Mountain, W. Va., Island Creek Coal Co. $850,000†

Two coal tipples, conveyor. At 3:00 A.M., while a maintenance man was welding on a loading boom at the first story level, molten metal ignited an accumulation of spray oil and coal dust on the boom. The spray oil was a 300°F. flash point residual oil that was applied to the coal at the ends of loading booms.

An attempt was made to control the fire with portable extinguishers, but the fire spread with great rapidity through the dusty 5,300 sq. ft., 60-ft.-high wood-framed, metalclad tipple. Employees attached hoses to a hydrant 250 feet from the tipple and a telephone alarm was sent to the nearest fire department 35 miles away.

In the meantime the fire spread to another tipple 12 feet away and started to spread through a 490-ft.-long overhead wooden conveyor that extended from the second tip-

†Figure includes business interruption loss.

Rapid City Daily Journal

Flooding of an oil-fired space heater was the probable cause of this $300,000 loss in a feldspar processing plant at Keystone, S. D. Fire spread to wooden wall and roof framing of the unsprinklered metalclad building. A shallow creek from which firemen hoped to get water was frozen.

ple to a large head house. The fire was stopped just before reaching the head house when employees dynamited the conveyor.

***Nov. 4, McCommas, W. Va., Pocahontas Fuel Co., Inc. $2,500,000†**

Coal cleaning building; tipple. A 4- and 5-story heavy timber constructed, ironclad coal cleaning building of 7,400 sq. ft. area was destroyed by fire discovered by a nearby resident at 2:00 A.M. There was no local fire department, but departments from neighboring towns sent a total of three pumpers and twelve men. Due to delayed discovery the fire had spread beyond control in the cleaning plant and had involved part of the adjoining and communicating all-metal tipple when fire fighters arrived. Using water drafted from a creek and materially aided by a favorable steady wind, they were able to save most of the tipple.

On the day preceding the fire (Sunday) a large amount of machinery had been installed in the cleaning plant and tipple. Since the installation involved extensive use of cutting and welding torches it is suspected that cutting or welding sparks started the fire. There was no watchman protection.

Paint and Varnish

Feb. 25, Cleveland, Ohio, The Glidden Co. $2,400,000

Cleveland Fire Department

Paint. At 10:08 P.M. an employee discovered fire in the basement of the 3-story section of this 1-, 3- and 4-story reinforced concrete building. The basement where the fire started was used for storage of cans of paint in cardboard cartons. Although an attempt was made to fight the fire with extinguishers prior to the arrival of the fire department, the fire was already out of control and soon spread horizontally to the communicating sections and vertically through chutes and other vertical openings to the upper stories.

Due to the intense fire created by the flammable liquids released from ruptured paint and other flammable liquid containers and from equipment, the cinder concrete roof and the first floor of the 3-story section (erected in 1907) collapsed.

Good fire fighting prevented complete involvement of communicating sections of the building despite frequent explosions of containers of flammable liquids.

Prior to the fire plans for sprinkler protection had been approved but installation had not begun.

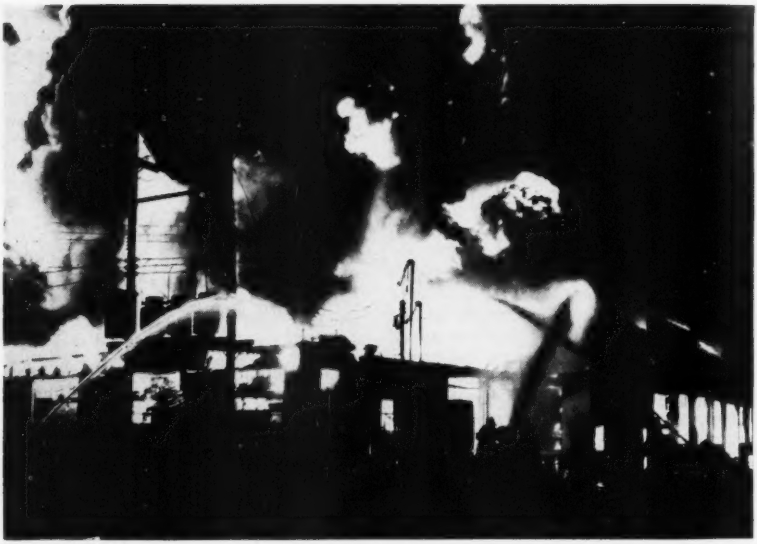
May 24, Chicago, Ill., DeMert and Dougherty $518,000

Wide World

Paint. Fire that destroyed the 350 ft. by 75 ft. 1-story brick, steel-framed building originated with an explosion at a can filling machine when a static spark apparently ignited paint solvent vapors. Instead of notifying the fire department at once, employees delayed the alarm until after unsuccessful efforts to control the fire with portable extinguishers. This deliberate failure to send the alarm at once allowed the fire to spread beyond control in the unsprinklered building before firemen arrived.

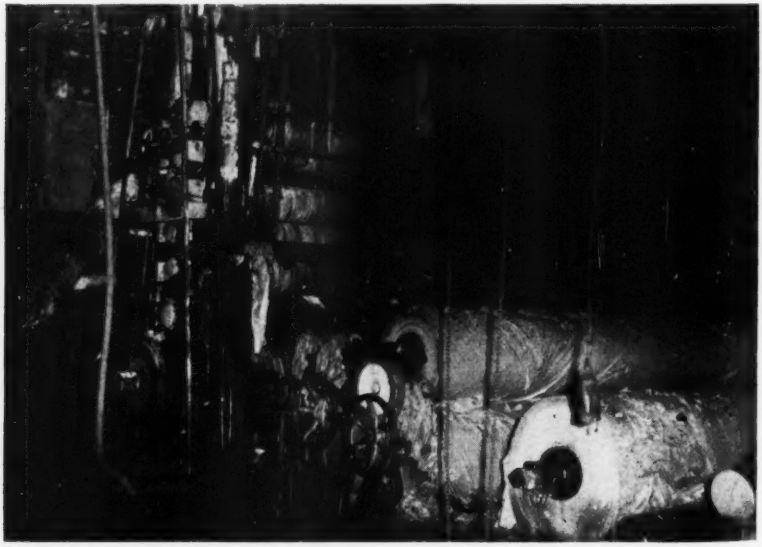
*Fire spread to other buildings.

†Figure includes business interruption loss.



Norristown Herald, Inc.

Although discovered by employees, fire in this paint canning factory at Norristown, Pa. was out of control when firemen arrived. (See report, page 241.)



Western Star

Seven paper machines were severely damaged at this sprinklered paper mill at Corner Brook, Nfld. (See report, page 241.)

Aug. 8, Norristown, Pa., Krylon, Inc., et al. $1,180,000†

Packaging enamels, lacquers, insecticides in pressurized cans; pipe and railing manufacture. The 1-, 2-, and 3-story masonry, steel-framed building destroyed by this fire contained 60,000 sq. ft. of floor space equally divided between two tenants. The building was not sprinklered and had no watchman protection.

At 10:40 P.M., during a 10 minute rest period at the can filling occupancy, one of the employees in the yard saw fire in the storage room where filled pressurized cans packed in cardboard cartons awaited shipment. As the alarm was telephoned explosions of the small cans started to occur and the fire was soon spreading rapidly through the building. Several severe explosions occurred that hurled the cans several blocks from the fire. With the fire out of control before it arrived the local fire department concentrated on protecting exposures.

Paper Mill

April 20, Corner Brook, Nfld., Bowater's Newfoundland Pulp and Paper Mills, Ltd. $5,000,000

Newsprint and sulfite pulp. Seven paper machines were severely damaged and the wood roof of the 50-ft.-high 1-story building was burned through in several places by fire that originated at the back of one of the paper machines. The plank on steel frame machine room roof and economizers (heat exchangers) were protected by automatic sprinklers. Deluge sprinkler protection was installed over driving gears. Water for sprinklers consisted of a 10-inch connection to a 12-inch public main at 90 psi. In addition there were three centrifugal fire pumps, each capable of supplying 3,000 gpm at 125 psi. Unfortunately all of this water was not available for fire protection since over 800 domestic and process connections were taken from the fire mains and suction supply was inadequate to supply the three pumps when operating simultaneously.

The most probable cause of the fire was ignition of oily broke on the floor at the drier end of the machine by sparks from a steam head. Burning paper is believed to have dropped through a hole in the floor and ignited lint, oil, dust and a large accumulation of broke in the unsprinklered noncombustible basement. When discovered, the fire was burning up through all machines from the basement. Deluge systems operated over driving gears but the fire in the machines and basement was not within reach of this protection and flames were greatly intensified by oil that escaped from lubricating system piping when couplings broke due to the intense heat.

Fire extended to unsprinklered hoods and then to the roof and soon had opened more than 1,000 sprinklers. This large number of fused sprinklers in combination with the operating deluge systems reduced the water pressure to such an extent that sprinkler protection was ineffective. Standpipe hose streams used by the plant's fire brigade were also ineffective until the deluge systems were shut off, after which the brigade was able to attack the roof fire and the fire in the first story and basement. Taking suction from a dam the city fire department assisted the plant brigade and had the fire under control in four hours.

Paper Working

Jan. 10, Houston, Texas, St. Joe Paper Co. $1,668,500†

Cardboard boxes. Structural and private fire protection weaknesses combined to cause total destruction of the 115,456 sq. ft. 1-story unprotected steel-framed building. At 3:15 P.M. some of the 60 employees in the building noticed fire at a pile of baled scrap cardboard at one end of the undivided building. Instead of telephoning the fire department at once they spent about 10 minutes discharging several of the 61 extinguishers in the building (fifty-seven 1-quart vaporizing liquid, two 2½-gallon foam and two 40-gallon foam extinguishers). The fire could not be controlled by these devices and had spread before wind that entered through large open doors at one end of the building. Lint on machinery, walls and the underside of the roof, and asphalt that flowed through cracks in the warped steel deck of the built-up roof were important factors in the rapid spread of fire which was burning intensely when firemen arrived and caused the roof to collapse a few minutes later.

Fire fighting was hampered by poor water supplies and insufficient hydrants near the building. Although this public protection weakness was not an important factor in this particular loss due to the extent of fire when

†Figure includes business interruption loss.

Houston Post

A 10-minute delay in fire department notification as employees tried to control fire with extinguishers was just one of several factors that combined to cause this $1,668,500 fire at Houston, Texas. (See report, page 241.)

firemen arrived, it might well have been a vital handicap had firemen arrived before the fire had spread through the building. Reports point out that had the building been sprinklered the fire would probably have been confined to the area of origin.

July 16, Rockland, Del., Doeskin Products $900,000

News-Journal Co.

Paper napkins, facial and toilet tissue. At 2:30 A.M., about 30 minutes after the watchman went through the second story of the 300 ft. by 60 ft. 2-story building, one of the three or four employees in the second story saw fire on a wall where several electric switch boxes were located. After instructing another employee to telephone the fire department, the man who discovered the fire fought it with portable extinguishers but to no avail as the flames spread to nearby piles of tissue paper and spread rapidly through the second story feeding on paper dust on structural members and on paper on machines that extended almost the entire 300-ft. length of the second story. Sprinklers opened without delay but because of the rapidity with which the fire spread through the building the fire was always ahead of the opening sprinklers and soon had fused so many that the system could not supply an adequate amount of water to all sprinklers simultaneously. Sprinklers were supplied by a 40,000-gallon elevated tank and a 1,000 gpm steam fire pump. Fire also extended through unprotected floor openings and involved part of the first floor. Eventually 452 of the 550 sprinklers in the building opened.

Aug. 4, Lockland, Ohio, The Gardner Board and Carton Co. $1,310,000†

Paper mill and carton making. Half of this 43,000 sq. ft. 1-story brick, wood-joisted building was extensively damaged by fire that originated in the basement where scrap accumulated from cutting and trimming machines. It is thought that some of the scrap became entangled in a belt drive and was ignited by friction. Sprinklers that normally would have been expected to control such a

†Figure includes business interruption loss.

fire did not operate because, as was later discovered, the valve controlling sprinklers in that half of the building was closed.

An employee discovered the fire promptly and the fire department was called at once, but the fire spread rapidly through that half of the basement where sprinklers were inoperative, spread vertically through open stairways and machinery openings to that half of the first story where sprinklers were also shut off. It had involved the roof when firemen arrived. Sprinklers protecting the other half of the basement and first story performed satisfactorily and kept the fire from spreading into that half of the building. Firemen brought the fire under control with eight 2½-inch hose streams.

Why the valve controlling sprinklers in half the building was closed when the fire occurred, although it was known to have been open six hours earlier, apparently has not been determined. Discovery of a broken sprinkler fitting in the basement suggested that the system may have been damaged necessitating that it be shut off.

Sept. 14, Orangeburg, N. Y., Orangeburg Manufacturing Co. $1,000,000†

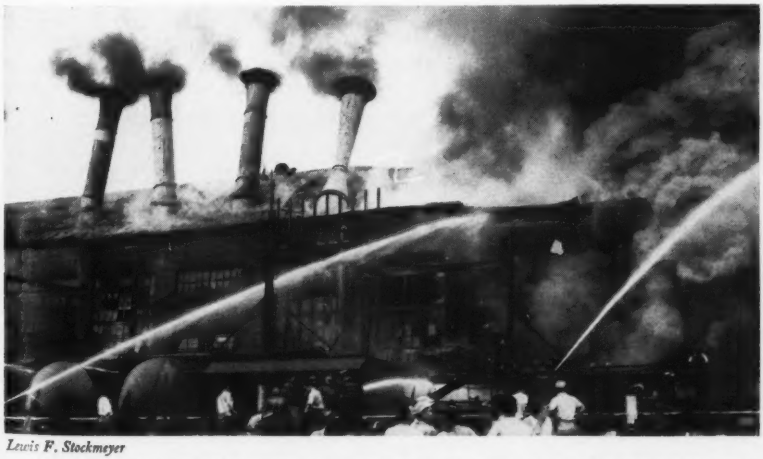
Pitch impregnated fibre pipe. Arcing at an overhead electric crane was the probable cause of fire that was on top of a hood extending over pitch impregnating kettles when first noticed. The fire spread to a kettle where employees attacked it with dry chemical extinguishers and almost had it out when all extinguishers were emptied. Since no one turned on the manually operated open sprinklers beneath the hood, the fire then spread rapidly beneath the hood. Large quantities of heat from the burning pitch tanks ignited the wood roof where the fire spread rapidly over pitch residue and had soon opened so many ceiling automatic sprinklers (about 500) that the water supply was overtaxed. No connection was available through which the fire department could pump into the sprinkler system. Before the fire was controlled by eight 2½-inch and six 1½-inch fire department hose streams part of the roof and most of the contents of the 19,000 sq. ft. high 1-story brick, steel-joisted building had been destroyed.

†Figure includes business interruption loss.

Plastics Manufacturing

April 24, Pittsfield, Mass., General Electric Co. $500,000; 3 killed

Three employees were killed when an explosion occurred in a kettle in which a phenol-formaldehyde polymerization reaction was taking place. The three-ton cover of the kettle was shattered and the kettle was driven downward into the ground. The



Lewis F. Stockmeyer

Employees at a fibre pipe plant at Orangeburg, N. Y. were holding this fire in check with extinguishers until they ran out of extinguishers. Manually operated sprinklers over impregnating kettles were not turned on.

Kokomo Tribune

A bucket of roof patching tar started this roof fire at a printing plant in Kokomo, Ind.

fact that the walls were not load bearing and had large window areas were major reasons that building damage was not severe. The explosion broke sprinkler piping but there was not much combustible material in the noncombustible building and the loss of sprinkler protection was not as serious as it might have been.

A runaway reaction due to addition of too much catalyst or addition of the catalyst at the wrong time is a possible explanation for the explosive rupture of the kettle.

Printing Plants

July 9, Baltimore, Md., Barton-Cotton, Inc., et al. $552,000

Three printing plants. This large 1-story brick, wood-joisted building and its contents were severely damaged by fire that was beyond control when discovered by a passerby at 2:49 A.M. The building was unsprinklered and had no watchman protection. The consequences of the absence of this private protection can be appreciated from the fact that two 13-year-old boys admitted that they had accidentally started the fire with lighted matches while burglarizing the premises.

Sept. 25, Kokomo, Ind., Cuneo Press of Indiana, Inc. $500,000

Magazine and catalogue printing and binding. Most of the multi-layered composition roofing that had been placed on the original tile on gypsum roof of this block-long building was destroyed. The fire originated at one end of the roof when a bucket of hot tar used by roof patchers ignited. Spreading before a brisk wind the flames burned off the composition roof covering and burned the similar covering on the plywood sides and roof of several long monitors. Confronted with the large-area fire on the roof (roof heights 40 feet to 63 feet; monitor heights 68 feet to 75 feet) firemen immediately transmitted extra alarms and in 20 minutes had called all available equipment to the fire.

The building was protected by several wet and dry sprinkler systems. As the fire spread along the roof heat fused 1,002 sprinklers. These may have been of limited value in cooling the steel roof supports, but considering the fact that the water supply was capable of supplying 37 sprinklers at 15 psi the principal credit for preventing collapse of unprotected steel roof supports must go to the hose streams that were directed at the under side of the roof from inside the building. The fire was extinguished in 2½ hours. Most of the composition roof covering had been de-

stroyed but very little fire damage occurred inside the building. Water damage to rolled and flat paper and to presses was heavy.

Refineries — Petroleum

Jan. 8, Montreal East, P. Q., Shell Oil Company of Canada, Ltd. $3,164,500†; 1 killed

During filling of a sphere, butane overflowed into the diked area in which three spheres were located. Some of the butane remained as a liquid but a large vapor cloud also formed that spread over an extensive area, unknown to employees. At approximately 4:15 A.M. the vapor cloud ignited. An intense fire broke out in the diked area around the spheres, and explosions occurred in pump houses and other buildings. One employee was fatally burned. When two spheres exploded, debris was thrown over a large area and several tank fires started.

The refinery fire brigade with the help of other private brigades and public fire departments brought the fire under control within 24 hours and had completed extinguishment in another 24 hours.

Jan. 29, 1957, Whiting, Ind., Standard Oil Co. (Indiana) $3,000,000

Alkylation unit. Three interconnected large pressure tanks in which propane from an alkylation unit depropanizer was stored were destroyed by a violent explosion that occurred when a valve was opened to relieve pressure above the stored liquid propane. The explosion also occurred in the vent line which discharged into the refinery fuel gas line. A high concentration of oxygen in the vapor space of the tanks was probably an important factor responsible for this explosion. No employees were killed but the explosion damaged the alkylation unit, destroyed several small buildings and started several fires at storage tanks, many of which were destroyed before the fire was controlled.

†Figure includes business interruption loss.

April 9, near El Dorado, Ark., American Oil Co. $500,000

Crude oil refinery. Failure of the wall of a 12-ft. diameter by 70-ft. high vacuum tower while operating under 29 inches of vacuum caused the tower to cave in and fall on several elevated product lines. Hot oil that escaped from the tower ignited, and with additional flammable liquids from broken piping feeding the fire, flames started to spread in all directions. However, the refinery fire brigade with the assistance of the public fire department and two other private brigades soon had five 2½-inch foam lines, one 2½-inch water spray line and a monitor nozzle in operation. With this equipment they were able to confine the fire to within a radius of 150 feet from the tower.

Dec. 4, Meraux, La., Ingram Products Co. $1,000,000; 1 killed

Tank farm at petroleum refinery. While a tank gager was closing a valve through which gasoline was being pumped into a 14,000 barrel aboveground gasoline storage

Wide World

At Meraux, La. fire broke out following collapse of a 14,000 barrel aboveground gasoline storage tank.

tank, the tank collapsed and caused a wave of gasoline to spread over dikes to adjacent storage tanks. The gager was killed. Fire immediately broke out and involved eight other tanks containing 47,000 barrels of gasoline, 10,000 barrels of diesel oil and 2,100 barrels of fuel oil. Cast iron fittings failed releasing additional flammable liquids. When the tank of origin ruptured it fell across a dike spilling gasoline into a drainage ditch where four railroad tank cars were located at a loading rack. Burning liquid spread 300 feet through the drainage ditch between dikes of uninvolved tanks, rupturing product pipelines elevated above the ditch, involving product pump houses located in the ditch and also a 1,000 gpm fire pump located in the same ditch.

Several refinery fire brigades and public fire departments that responded divided into groups, each group concentrating on a particular area of the fire. The attack consisted essentially of wetting exposed but uninvolved tanks with water spray and controlling the fire in the drainage ditch and involved diked areas with foam. With three product pumps in the fire area, gasoline and other flammable liquid spilled into the ditch until volunteers wearing asbestos suits worked their way to the pump houses under cover of water spray and closed the valves. Loss of the fire pump was also a serious handicap to fire fighters. During the early part of the fire, water was used from the refinery area about 1,800 ft. from the tank farm and was also taken from a public main that went past the refinery. This water supply was not adequate for the many water and foam streams required to extinguish the fire and it was fortunate that a New Orleans fire boat was dispatched. Water pumped by the boat from the Mississippi River through two 1,500 ft. long 3½-inch hoses at 180 to 200 psi supplied four 2½-inch hoses at 60 psi. This additional water from the fire boat was considered to be the outstanding factor in the fire control.

Rubber Reclaiming

***Feb. 10, Toronto, Ont., National Rubber Co. $626,500**

Rubber reclaiming. Two unsprinklered buildings were destroyed and two others badly damaged by fire that originated in one of the buildings while the plant was closed for the week end. When discovered by a passerby at 7:46 A.M. Sunday, the fire was

*Fire spread to other buildings.

Zito Studios

The largest industrial fire loss of 1957 occurred at this rubber reclaiming plant at Butler, N. J. **(See report, page 247.)**

The Globe and Mail

beyond control in the congested buildings. Flames also spread to piles of old rubber tires piled close to the buildings.

*Feb. 26, Butler, N. J., Pequanoc Rubber Co. $14,076,000†

Scrap rubber reclaiming including drying. Spontaneous ignition of reclaimed rubber in a large sprinklered drier on the top floor of a sprinklered 3-story brick, plank-on-timber building was the probable cause of fire that severely damaged the group of interconnected buildings which comprised this plant.

Automatic sprinklers and a steam smothering system in the drier operated and as employees brought standpipe hoses into action it appeared that the fire would be quickly extinguished. However, due to the dense smoke, no one was immediately aware that when the fire first occurred (12:10 A.M.) flames had burst from openings in the drier and ignited lint and dust on the beams overhead.

When fire was discovered spreading beneath the ceiling at 12:16 A.M. an employee ran outside to pull a public fire alarm box and then on hearing a shout for "water" checked the post indicator valve controlling sprinklers in the fire area. He was not aware that this particular valve was one of a few left hand valves at the plant and consequently closed the valve under the impression that he was opening it.

Flames then spread rapidly through the area of origin. Sprinklers supplied by a 1,000 gpm steam fire pump kept fire from adjoining areas until 12:40 A.M. when a large high pressure steam line in the fire area ruptured dropping the steam pressure in the boiler sufficiently to stop the fire pump. Thereafter the fire spread through the plant.

*Fire spread to other buildings.

†Figure includes business interruption loss.

Shipyard

Jan. 29, Alameda, Calif., Todds Shipyard, et al. $500,000; 10 killed

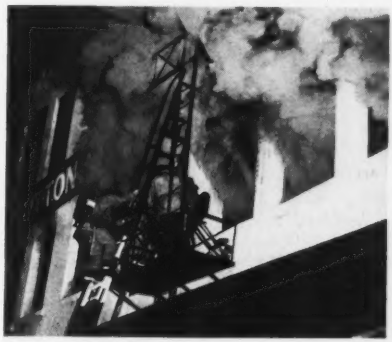
10,633 gross ton T-2 tanker "Jeanny." Ten workmen were killed and 43 were injured in two explosions aboard the tanker while being reactivated. The first explosion bulged and opened the port deep tank, blew openings into the engine room and ripped open part of the deck. No fire followed this explosion but a second explosion ten minutes later (while rescue operations were still in progress) was followed by an intense fire in the engine room that had to be extinguished by water and foam streams before men could again enter the engine room to search for victims.

For several hours prior to the explosion the fuel oil in the deep tanks had been steam heated so that it could be pumped to a burner being used to dry new brick work in a boiler. A heavy concentration of vapors had been reported and two expansion trunk covers that were found open were secured. However, no one noticed that the cover was off the Butterworth hole leading to the port deep tank. Vapors escaping from the Butterworth hole were ignited by a welding operation near the hole on deck and flames flashed back into the deep tank where the first explosion occurred.

Tests made of the fuel oil in the deep tank revealed that it contained a small amount of 75° to 80°F. flash point liquid.

Textile Working

Feb. 11, Los Angeles, Calif., Cal-Button, Inc., et al. $750,000

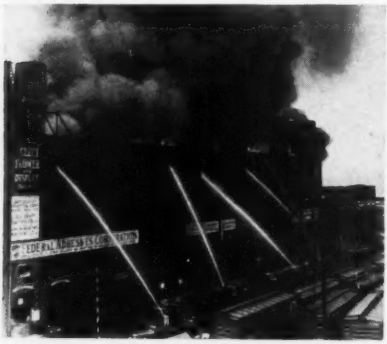


Los Angeles Examiner

Cloth buttons, belts, shoulder pads, table linen. Originating in the shipping and office area of the button factory on the first floor, fire had spread throughout the entire 5,000 sq. ft. first story of the 3-story brick, wood-joisted building before a fireman in a station a block away looked out and saw the flames at 10:14 P.M. The building was left without watchman protection during nonoperating periods and sprinkler protection was installed in the basement only.

Fire from first story windows entered the second story by means of a spray booth discharge outlet in a second story window and was spreading through large stacks of combustible material, wood partitions and shelving in the second story when apparatus arrived. The fire in the first story was knocked down quickly, but due in part to the inability of the canister-type breathing equipment to offer complete protection against the fumes from the burning plastic used in belt making, firemen were delayed in entering the second story. Large hose streams were directed through windows, but near the center of the building in a section that could not be reached by the streams, fire burned through the ceiling and entered the undivided third story. Finally the fire-weakened roof fell in.

March 6, New York (Brooklyn), N. Y., Select Flower Display Co., et al. $1,000,000; 2 killed



Dan Sforza

Artificial flowers, adhesives, dolls, bottle storage. The second and third stories of the 56,000 sq. ft. 3-story brick, wood-joisted building were burned out by fire that originated in the artificial flower factory occupying part of the third story. The building was protected by dry pipe sprinkler systems but because of conditions conducive to a flash fire in the top story, because of badly overloaded dry valves, inoperative quick opening devices, poor water supply that was capable of supplying only about 30 sprinklers at adequate pressure in this area of origin, and because of excessive areas the sprinklers could not control the fire.

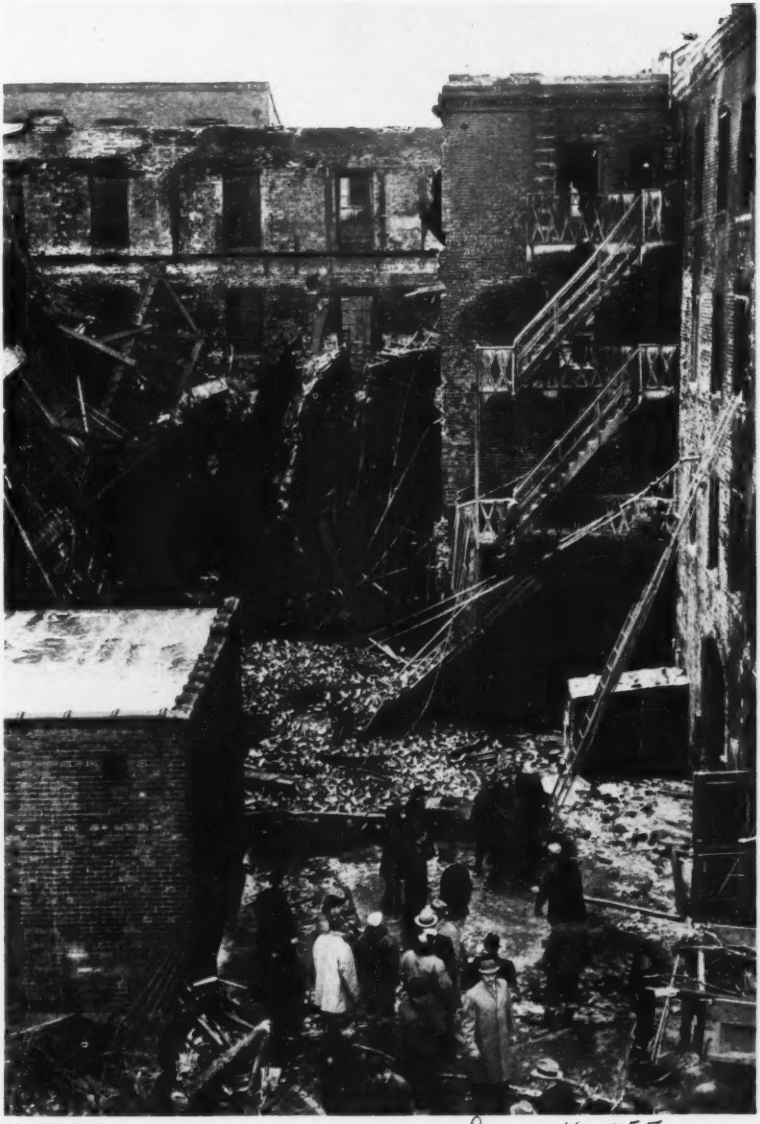
The fire originated from an unknown cause at one of four unenclosed metal spray hoods. The fire quickly involved the spray area, involved 50 gallons of lacquer stored in ordinary cans nearby and then spread rapidly through the third story which was congested with work tables, shelving and large quantities of artificial flowers. The building engineer reported that three or four dry pipe valves tripped in rapid succession. One of the first engine companies pumped into the sprinkler system and continued to do so until sprinkler piping in the top story broke. Forty-one 2½-inch hose streams were used to confine the fire to the third and second stories.

More than 100 people in the building escaped safely but two employees of a toy factory that occupied parts of the second and third stories of the building lost their lives. These men were in a storage room in the third story which was separated from the artificial flower factory by a wooden partition. Apparently the fire spread through a doorway in the partition (one of two exits available to them) and cut off their other escape route via the stairway between the second and third stories of the toy factory.

March 7, Schuylkill Haven, Pa., Argo Knitting Mills, Inc. $1,381,000

Cotton knitting, dyeing, bleaching. Smelling smoke, employees traced it to the concealed space between the first story gypsum board ceiling and the second story flooring. Instead of calling the fire department at once, they started to pull down sections of the ceiling and rip up floor boards, thereby permitting air to enter the concealed space and intensify the burning. When flames burst from the openings made in the concealed space the fire department was called.

Sprinklers operated in the second and third stories but had no effect on the fire spreading within the concealed wall and ceiling spaces. Fire broke into the open in several locations throughout the 3-story brick, wood-joisted building and eventually opened so many sprinklers that the single source water supply (6-inch city mains) was overtaxed by the



Mongillo's Studio Jan. 24, 1957

Fifteen of the 120 people in this New Haven, Conn. multiple occupancy building (four clothing factories, one welding shop) lost their lives in fire that originated in rubbish in the first story hallway. The latched-up swinging stair (lower section) of the fire escape shown in the photo caused a jam on the escape. Ten deaths involved people trapped on the fire escape. (See report in February 1957 NFPA Fire News, page 10.)

simultaneous demand by sprinklers and fire department hose streams. Pumpers supplemented this water supply by drafting from the Schuylkill River. None of the pumpers pumped into the fire department connection in the sprinkler system, the fire chief being of the opinion that the fire had made so much headway by the time apparatus arrived that it would have been of no value to use this means to get water on the fire.

Sept. 15, Souderton, Pa., His Nibs Shirt Corp. $925,000

Shirts. Forty-five minutes after the substitute unsupervised watchman went off duty (6 A.M. Sunday) a passerby discovered fire in the undivided and unsprinklered 16,000 sq. ft. 1-story brick, steel-framed building. The fire originated in the vicinity of coffee and soft drink machines, spread over cardboard cartons, cloth and oily machinery, and had made so much headway when firemen arrived that they were unable to enter.

Oct. 29, North Vernon, Ind., Regal Rugs, Inc. $561,500†

Cotton bath mats. The manufacturing areas of this unsprinklered 19,000 sq. ft. 1-story masonry, wood-joisted building were destroyed by fire that originated in a small, partially open shed built against one wall. The shed housed the motor that operated an exhaust fan for a metal spray booth. The exhaust fan was mounted in the center section of a multipane window. Liquid latex backing material was applied to the mats in the booth and overspray and vapors were exhausted into the small shed. The heavy residue that collected on the floor was difficult to ignite, but a light fluffy deposit that accumulated beneath the roof of the shed burned readily.

A short circuit in the exhaust fan motor was the probable cause of the fire. Just before the outbreak two fuses in the motor circuit had blown in succession. On discovering the blaze in the shed, employees attacked it with extinguishers but the fire spread through the communicating window to the inside of the factory and spread rapidly over lint that had accumulated on the combustible fibreboard ceiling.

When the town's 750 gpm pumper arrived with one man at 4:20 P.M. (15 minutes after the fire was discovered) flames had spread throughout the processing and shipping room and had broken through the roof. While two lines were being laid from the hydrant-connected pumper the town's 500 gpm pumper arrived with one man and attempted to supply a line from another hy-

†Figure includes business interruption loss.

Souderton Independent

A passer-by discovered fire at this Souderton, Pa. shirt factory at 6:45 A.M., Sunday, 45 minutes after the night watchman had gone home.

Ledger Enquirer

As demonstrated by this fire in a tire recapping plant at Columbus, Ga. the fire load in a building must be taken into consideration when determining the adequacy of fire resistance for structural members.

drant, but the driver did not know how to operate the pump so the second pumper was not used. In the meantime the fire had spread into the sewing room and would have involved the storage area but for a parapeted masonry fire wall with the single opening protected by a fire door. When pumpers from surrounding towns arrived a successful stand was made at the fire wall.

Tire Recapping

*May 25, Columbus, Ga., United Oil Corp. $500,000

Tire recapping, garage, storage of recapping materials and household appliances. The 12,202 sq. ft. 1-story brick, steel-framed building where the fire started was destroyed and an adjoining and communicating 4-story "fire-resistive" building was so severely damaged that it was condemned by the city. Neither building was sprinklered, and the 4-story building, although reported to be of "fire-resistive" construction demonstrated the fundamental principle that the fire load of a building must be taken into consideration when determining adequate fire resistance for structural members. In this instance columns and girders were insulated with 2 inches of concrete, and floor and roof slabs were 3½-inch reinforced concrete. Since the upper stories of the building were loaded with rubber tires, rubber recapping material, house appliances and department store merchandise, it is not surprising that parts of the roof and two upper floors collapsed.

The fire originated in the 1-story building in a wood-partitioned tire recapping area. It broke out on the floor beneath a barrel of rubber cement solvent as an employee was trying to tighten the leaking spigot. Flames spread to rubber dust on the ceiling and partitions and rapidly involved the 1-story building.

It is estimated that at the most there was a 5-minute delay in telephoning the fire department. During this time and the minute or two required for apparatus to respond, the fire had spread through unprotected first story openings to the first floor of the 4-story building and was making so much headway in the latter building that fire fighting was immediately directed toward protecting other exposed buildings. Fire spread to upper stories through open stairways and elevator shafts and also by means of wired glass windows overlooking the roof of the 1-story building. Tires were stored on wooden racks in front of several windows.

*Fire spread to other buildings.

Grand Rapids Press

Violations of several fundamentals of fire-safe yard storage were responsible for this $725,000 fire at a boat factory in Grand Rapids, Mich.

Woodworking

Boats

Feb. 19, 1957, Grand Rapids, Mich., Wagemaker Co., et al. $725,000

Wooden boat hulls. Destruction of 1,200 yard-stored finished boat hulls and half of an adjacent 1-story wood-framed, metalclad crating building containing 300 boats was due to the violation of fundamental principles of outdoor storage. The boats (packed in excelsior, waterproof paper and wood crating) were piled four boats high in a 25,000 sq. ft. three-sided yard storage area bounded on two sides by streets and on the third side by the crating building. The street sides were fenced and a 40-ft.-wide driveway separated the storage area from the crating building. However, no clear space was left between the fences and storage, and boats were temporarily stored in the driveway. Except for one 25-ft.-wide driveway that divided the storage area it was completely covered by the closely packed boats.

Careless disposal of smoking materials by someone passing the yard was the probable cause of the fire which, when discovered by an employee, was confined to a pile of four boats against the fence at the down-wind end of the yard. Employees were available to fight the fire but since no yard hydrants and hose were provided, private fire fighting was confined to the use of portable fire extinguishers. These efforts were inadequate and by the time the fire department arrived, fire had spread against a 10-15 mph wind to about half of the yard and had entered the crating building. Although employees stated that the alarm was telephoned at once, the extent of the fire when firemen reached the scene indicated that the alarm may have been delayed.

Despite long distances to hydrants requiring hose lays of 1,000 feet to 1,600 feet, fire fighters prevented spread to exposed buildings and with the help of a substandard fire wall saved half of the crating building.

Saw and Planing Mills

***Sept. 22, Kennydale, Wash., Pan Abode, Inc., et al. $910,500**

Prefabricated houses, laminated timbers, saw and planing mill. During a period of

*Fire spread to other buildings.

shutdown for repairs, fire broke out in the unsprinklered 40,000 sq. ft., high 1-story wooden building used for the manufacture of prefabricated houses and laminated beams. Fifteen minutes after the fire was discovered the building started to collapse into an adjoining lumber yard where more than 1,000,000 board feet of lumber was stored.

Flames quickly spread through the lumber before a 10 mph wind to the sprinklered 1- and 2-story sawmill and planer building. The entire exterior of the wooden building ignited and although water discharged from sprinklers inside, it had no effect on the fire burning on the outside and eventually the building was destroyed.

Industrial Fires with Losses from $250,000 – $500,000

Batteries

June 15, Spring Valley, Pa., Bowers Battery and Spark Plug Co. $250,000

Chemical Plants

March 20, Linden, N. J., Merck and Co. $270,000; 3 killed
Sept. 4, Vancouver, B. C., Electric Reduction Co. of Canada Ltd. $300,000†
Dec. 13, Elkton, Md., Thiokol Chemical Corp. $250,000; 5 killed

Concrete Mixing Plant

Oct. 28, near Massena, N. Y., Walsh Perini Co. $450,000

Electric Generating Plants

May 24, near Tulsa, Okla., Public Service Co. of Oklahoma $350,000
May 29, near Tulsa, Okla., Public Service Co. of Oklahoma $250,000
Sept. 14, Fitchburg, Mass., Fitchburg Gas and Electric Light Co. $260,000†

Fertilizer Plants

April 3, South Norfolk, Va., F. S. Royster Guano Co. $450,000
June 23, Avon, Pa., Lebanon Chemical Corp. $400,000

Food and Food Products

Animal Feeds

March 17, Voorheesville, N. Y., G. B. Vunck and Son $354,000
June 26, near Madera, Calif., Triangle T Ranch $283,000
Dec. 5, Pulaski, Tenn., Richland Mills $253,000

Bakeries

Feb. 19, Edmonton, Alta., Dainty Cake Bakery $329,000

Canneries

July 10, Oroville, Calif., Stokely Van Camp $300,000
Nov. 23, Anacortes, Wash., Farwest Fisheries, Inc. $400,500

Cereal Mills

Sept. 16, Oakland, Calif., Albers Milling Co. $450,000†; 3 killed

Flour Mills

*May 17, Charles Town, W. Va., Peoples Supply, Inc. $256,000
Oct. 1, Bay City., Mich., Wenonah Flour Milling Co. $250,000; 1 killed

Gas Manufacturing

Oct. 8, Plymouth Twp., Pa., National Cylinder Gas Co. $250,000

Glass Works

Jan. 19, Gas City, Ind., Owens-Illinois Glass Co. $281,000†
May 29, Portland, Ore., Moorehouse Glass Co. $258,500
*July 7, Elizabeth, N. J., Colorescent Lighting, Inc. $313,000

Leather Working

May 8, Berwick, Maine, Prime Tanning Co., Inc. $250,000
Sept. 7, Georgetown, Ohio, The P. Sullivan Shoe Co. $408,500

Metalworking

Aluminum Extrusion

April 12, McCook, Ill., Gardiner Extrusion Co., et al. $280,000

Aluminum Fabricating

*July 29, near San Jose, Calif., Aeromotive Metal Products Co., et al. $275,000

Electrical Appliances, Equipment

*April 14, Chicago, Ill., Wesco Electric Co., et al. $342,000
July 18, Portland, Ore., Electro Measurements, Inc., et al. $398,000
Dec. 2, Saratoga Springs, N. Y., Saratoga Industries $275,500

Engine Rebuilding

July 17, near Yukon, Okla., Page Aircraft Industries, et al. $465,000

*Fire spread to other buildings.

†Figure includes business interruption loss.

Foundries

Jan. 30, Henderson, Nev., United States Government, et al. $347,000† (Titanium)
July 18, Lincolnwood, Ill., National Die Casting Co. $250,000† (Aluminim)
Dec. 17, near Rockwood, Tenn., Tennessee Products and Chemical Corp. $350,000† (Ferro-silicon; ferro-chrome)

Railroad Repair Shops

Feb. 28, Milwaukee, Wis., Chicago, Milwaukee St. Paul and Pacific Railroad $399,000

Steel Fabricating

Feb. 10, DeKalb, Ill., DeKalb Commercial Body Corp. $360,000†
March 6, Toronto, Ont., Mason and Risch, Ltd. $283,000
March 13, Maywood, Ill., Western Supply and Furnace Co. $332,000
March 15, Sacramento, Calif., Vita Freeze Equipment Co. $332,000
May 2, New York (Bronx), N. Y., Foremost Fountains Co. $250,000
June 14, Columbus, Ohio, Weinman Pump and Mfg. Co. $275,000
June 25, Ionia, Mich., Mitchell-Bentley Corp. $291,500

Steel Forging

Aug. 27, near Colorado Springs, Colo., Aircraft Mechanics, Inc. $375,000

Mining

Jan. 15, Keystone, S. D., International Mineral and Chemical Corp. (Consolidated Feldspar Department) $300,000
*Sept. 22, Wyco, W. Va., Amigo Smokeless Coal Co. $374,000

Multiple Occupancy Manufacturing

Aug. 31, Gloucester, Mass., Gloucester Freezer Service, et al. $340,500 (Wooden boxes, ice, freezer service)
Sept. 28, Dallas, Texas, Bierner and Son, et al. $280,000† (Hats, handbags, neckwear)

Paint and Varnish

March 13, Chicago, Ill., Tousey Varnish Co. $349,000†

Paper and Paper Products

*Feb. 22, Pasadena, Texas, Champion Paper and Fibre Co. $250,000†; 1 killed
Sept. 8, Millwood, Wash., Inland Empire Paper Co. $354,000

Plastics Fabricating

*March 16, Little Rock, Ark., Bowman, Inc. $340,000
April 15, Auburn Twp., Ohio, Carlon Products Co. $275,000
Sept. 25, Glenbrook, Conn., Cook Laboratories, Inc. $275,000

*Fire spread to other buildings.

Printing Plants

Aug. 26, Huntsville, Ala., U. S. Government $261,000

Refineries — Animal Oil

March 15, near Linkwood, Md., Eastern Shore Rendering Co. $293,000

Refineries — Petroleum

*May 6, Baton Rouge, La., Esso Standard Oil Co. $312,000

Refineries — Vegetable Oil

Nov. 1, Los Angeles County, Calif., Baker Castor Oil Co. $250,000

Shipyards

May 4, Alameda, Calif., Moore Drydock Co. $300,000
Nov. 9, Madisonville, La., Jahncke Service, Inc. $250,000

Stone Working

*Oct. 2, West Orange, N. J., Orange Quarry Co. $267,000

Textile Working

Jan. 9, San Francisco, Calif., Alice of California $400,000
Jan. 24, New Haven, Conn., Baer Bros., et al. $325,000; 15 killed
*Feb. 1, Cohoes, N. Y., Swanknit Co. $250,000
Dec. 16, Detroit, Mich., Acme Auto Batt Co., et al. $313,000†
Dec. 18, Los Angeles, Calif., Mildred's of California, et al. $337,000

Tire Recapping

*Feb. 16, Russellville, Ark., Blackford Tire Co., et al. $250,000
*July 30, South Wenatchee, Wash., Suggs Tire Service $319,000
Nov. 29, Vancouver, B. C., Bourne and Weir Holdings, Ltd. $300,500

Woodworking

Building Supplies

*April 16, Palmyra, N. J., Penn Jersey Lumber and Millwork Co. $280,000
*April 27, Neenah, Wis., Hardwood Products Corp. $263,500†
*May 13, Shakopee, Minn., Page and Hill Co. $300,000
*Oct. 3, Monclova Twp., Ohio, Rowe Window Co., et al. $250,000

Furniture Factories

Nov. 30, Fort Smith, Ark., National Glass and Manufacturing Co., Inc. $250,000

Saw and Planing Mills

*June 25, Somers, Mont., Devoe Lumber Co. $450,000
*Oct. 16, Portland, Ore., Kingsley Lumber Co. $284,000
Oct. 25, Giscombe, B. C., Eagle Lake Sawmills, Ltd. $258,000

†Figure includes business interruption loss.

Fifty-eight Large Loss Store Fires

The 58 fires in mercantile occupancies last year with individual losses of at least $250,000 were five more than in 1956 and were the most that have occurred in a single year. The total loss from these fires was $26,125,000. The four deaths included one fireman, two building occupants and one bystander, and the 208 injuries included 164 to fire fighters and 44 to building occupants and bystanders.

Twenty-three of the fires occurred in buildings housing more than one store (multiple occupancy mercantiles). Department stores accounted for 11 fires, furniture stores seven fires, restaurants seven, clothing stores three, supermarkets three, hardware stores two, five cent to a dollar stores and jewelry stores one fire each.

Thirty-six fires were discovered by outsiders, 18 by occupants, two by burglar alarms and two by miscellaneous other means. Discovery was delayed in 47 of the 58 fires. Why? The following facts will throw some light on the answer.

Delayed Discovery

Forty-six occurred during nonoperating periods and 42 occurred during the night. These two conditions will usually mean a delayed discovery fire unless automatic fire protection (automatic sprinklers, automatic fire alarm system) or standard watchman protection is provided. Stores not so protected leave fire detection during nonoperating periods to a chance passerby who, as large loss experience of any year will show, will

1-17-57

Lee Studio

A building housing seven stores in Clare, Michigan was destroyed by fire that started in the basement. In the absence of automatic fire protection, the fire developed until seen by a passer-by at 10:25 P.M. The building lacked standard division walls between stores and was topped by a continuous roof space.

Tucson Daily Citizen

Fire was through the roof of this shopping center near Tucson, Arizona when firemen answered an outsider's alarm at 11:22 P.M. The building was unsprinklered and was located in an area where no water was available for fire fighting.

in all probability not notice a fire in a building he is passing unless the fire is so large that it is beyond ready control by the fire department.

No Automatic Fire Protection

In last year's large loss store fires not one store where the fire originated was protected by an automatic sprinkler system or by an automatic fire detection system.

The Five Watchmen Failed

Watchman service was provided for five of the 47 stores in which discovery was delayed. It would be well for any store proprietor who is relying on a watchman to protect his property during nonoperating periods, to review his watchman service in the light of these five cases. Not one of the five watchmen was the first to discover the fire. In two cases the watchman failure was accounted for by the fact that the watchman service was provided by a so-called merchant patrolman who looked after several buildings and made only brief checks of each periodically. The fires in these two instances broke out and spread beyond control between checks. In one case the unsupervised watchman was asleep (fire finally discovered by police in a cruiser); in another the watchman made only occasional unsupervised rounds of the building, and in the fifth case the watchman was permitted to go home each night at midnight since employees customarily reported shortly thereafter. On the night of the fire no one had reported by 12:45 A.M. when the fire was discovered out of control by an outsider.

These five cases of watchman failure clearly indicate that it is false security to place the safety of valuable store property in the hands of a watchman unless he is properly trained, competent, and supervised, and unless the protection will be provided continuously during nonoperating periods.

18 Fires Discovered by Occupants

Discovery was delayed in half of the 18 fires that occurred when the buildings

were occupied. In other words, the presence of clerks or customers will not guarantee prompt fire detection, and automatic fire protection or standard watchman protection is as necessary during operating as nonoperating periods to assure prompt discovery of fire.

The nine fires discovered relatively promptly by building occupants but which nevertheless spread beyond control make an interesting study. In three of these, conditions at the start were such that the fires spread rapidly out of control despite prompt discovery (see report of fire in multiple occupancy building at New Castle, Del.). In the other six cases the advantage gained by prompt discovery was lost because the fire department was not notified at once. Three of the discoverers tried to fight the fires without the help of the fire department and gave the alarm when the fires had gotten out of control. In two instances burned telephone wires delayed fire department notification and in the last case the fire department was out at another fire when called.

Building Construction

Thirty of the 58 fires occurred in multistoried buildings, 28 in 1-story buildings. By far the largest number (43) were of brick, wood-joisted construction, six were all wood, three were noncombustible and five were of mixed construction. Only one was fire-resistive. This latter fire shows that a serious fire can occur in a fire-resistive building when the contents are combustible, when there is no automatic fire protection and when there are one or more violations of the fundamentals of fire-safe building construction. The fire originated during a nonoperating period at a compressor motor in the basement, spread to combustible materials on display counters and spread via open stairs.

Construction Weaknesses

The fire in the fire-resistive building spread from floor to floor because of open stairways. There were 18 other large loss store fires last year that spread beyond the floor of origin because of open stairways. In 48 fires, substandard features of building construction contributed to lateral spread of fire and in 33 fires, construction features contributed to vertical spread. In addition to the open stairwells, construction weaknesses frequently noted in the reports of the 58 fires were lack of division walls to subdivide excessively large areas (26), large undivided attics (15), combustible fibreboard and other combustible interior finish (15), concealed spaces above suspended ceilings (13).

Clothing and Dry Goods Stores

Jan. 14, Kansas City, Kans., Bodker's, Inc., et al. $646,000†

Two clothing stores, two shoe stores, jewelry and millinery stores. The clothing stores were the principal occupants, the other shops occupying space in the clothing stores. Ten minutes after one of the two clothing stores in the unsprinklered 75 ft. by 115 ft. 1- and 2-story brick, wood-joisted building had closed for the night the proprietor of the other clothing store smelled smoke and telephoned the alarm. Firemen determined that the fire was in the basement, but smoke and heat on the first floor were so intense that they had to take terrific punishment before they were able to get a few feet inside the first floor from the front and rear, chop holes in the floor and place four cellar nozzles in operation.

This attack at first appeared to be making headway but it was soon discovered that the cellar fire had entered concealed ceiling and wall spaces and was spreading throughout the building. About 30 minutes after the fire was discovered, heat and smoke became unbearable anywhere in the building and the attack had to be continued by directing hose streams through the clouds of smoke that poured from the building. After almost two hours flames finally became visible in the first story and almost immediately enveloped the entire building.

Reports indicate that no attempt was made during the early stages of the fire to ventilate the building by opening the roof over the stair and elevator shafts.

†Figure includes business interruption loss.

***Jan. 24, St. Joseph, Mo., Einbenders, Inc. $906,000†**

Ladies' clothing. One of the two buildings occupied by this store was destroyed and the the other was severely damaged by fire that was not detected until a burglar alarm was shorted by the fire and transmitted an alarm. Before apparatus arrived the entire interior of the high 1-story brick, steel-joisted building of origin was in flames. Fire doors held in the brick wall between this building and a 2-story brick, wood-joisted building in the rear which was used exclusively for offices and clothing alterations. However, when fire broke through the roof of the building of origin it jumped the unparapeted wall and ignited the roof of the 2-story building in the rear. The roof was destroyed.

Two fur vaults were in the basement of the building of origin. Water was 18 inches deep in one of the vaults which was not waterproofed. The other vault had been waterproofed.

Department Stores

March 30, Glendale, Calif., Webb Department Store $700,000†

Fire that originated in the baby furniture storage room on the top floor of the 4-story brick, wood-joisted building spread through combustible stock in the undivided and unsprinklered fourth story before being extinguished by fire department hose streams. Water and smoke damage on lower floors was heavy.

The fire was small when discovered by employees at 11:48 A.M. and could have been quickly extinguished had they known how to use the linen hose connected to a standpipe 20 feet away. Instead of removing all of the hose they left several folds on the rack. These prevented the water from flowing and led the employees to believe there was no water in the standpipe.

When the fire occurred hundreds of shoppers and employees were in the store. These were calmly leaving the building when firemen arrived. The evacuation proceedings and the heavy concentration of spectators and traffic prevented fire fighters from laddering the front of the building or getting hose lines to the fourth story until 12:15 P.M.

***Aug. 27, Reedsburg, Wis., Helms-Quinlan Department Store, et al. $1,041,500†**

Department store, shoe store, two taverns, hardware store, garage. Six buildings were practically destroyed by fire that originated in the basement of an unsprinklered 15,500 sq. ft. 2-story brick, wood-joisted building occupied by a department store. A watchman was in the department store, but discovery of the fire was delayed until a fire gas

*Fire spread to other buildings.

†Figure includes business interruption loss.

United Press

Fire that originated in the unsprinklered basement of this Milford, Connecticut department store was not discovered until seen by a passer-by at 10:47 P.M. Flames spread up open stairways to the first story as dense smoke prevented fire fighters from entering the basement.

United Press

explosion alerted police two blocks away at 2:00 A.M. The watchman later admitted being asleep.

Flames were coming out of first and second story windows of the department store building when the first fire apparatus arrived. Calls were sent to five neighboring towns for help, but before help arrived flames had jumped a parking lot to a 1-story repair garage and had also crossed an alley and entered a 2-story building through plain glass windows. Many hose streams supplied by hydrants and a river were soon in operation and it was thought the fire could be confined to the three buildings now involved. However, plain glass windows overlooking roofs of involved buildings and low or nonexisting parapets on party walls provided means for the fire to spread to three other buildings before it was finally stopped at an unpierced standard fire wall.

Dec. 4, Mad River Twp., Ohio, Beerman Stores, Inc. $860,000†

Lack of sprinklers, central-station-supervised automatic detection equipment or watchman protection allowed fire that originated in the basement to burn an estimated three hours before discovery by police at 3:14 A.M. The fire originated in a sales area where a large quantity of Christmas merchandise was on display and spread through much of the undivided 18,000 sq. ft. basement before fire fighters were able to bring it under control. Fire damage was confined to the basement but heat and smoke that spread through the combination stairway and escalator opening caused extensive damage to merchandise in the first story.

Nov. 3, Jenkintown, Pa., Sears Roebuck and Co. $500,000

At 7:00 A.M., Sunday, a policeman noticed fire in the 100 ft. by 30 ft. 1-story brick, wood-joisted building. By the time the town's two volunteer fire departments were on the scene fire had broken through the roof and within an hour of discovery much of the roof had collapsed.

The fire originated at a radio and TV display counter. What caused the fire to start could not be determined, but the cause of the spread throughout the building before discovery was clear — no sprinklers, no automatic fire alarm system and no watchman.

†Figure includes business interruption loss.

Martin D'Arcy

Destruction of this 354 ft. by 156 ft. 1-story masonry, wood-joisted building at Yardville, N. J. was due primarily to lack of automatic fire protection and poor public water supplies. The building housed more than 100 concessions.

Five Cent to a Dollar Stores

*Dec. 26, Springhill, N. S., Stedman's Five and Ten Cent Store, et al. $750,000

15 stores, 5 dwellings. Fifteen wooden buildings located on both sides of the main street were destroyed by fire that originated in the basement of a variety store and was discovered by a passerby at 10:20 P.M. Two hours earlier the proprietor of the variety store had removed ashes from the furnace in the basement and left them in containers in which there was combustible rubbish.

The fire spread through the 2-story wooden building, broke through the roof and was carried by high winds to other wooden buildings on both sides of the street. At the height of the fire electric power to the town's water pumps went off depriving firemen of water for an hour.

Multiple Occupancy Stores

Jan. 16, Springfield, Mass., Yale Clothing Co., et al. $750,000

Stores, offices. This 17,856 sq. ft. unsprinklered 2-story brick, wood-joisted building was destroyed by fire that originated in the basement. Short circuit at a meter board located in about the center of the undivided basement was the probable cause. Discovery was made by a passerby at 6:46 P.M., after all stores and offices had closed for the night. Flames spread up open stairways and elevator shafts to upper stories, entered nonfirestopped walls and could not be brought under control until after midnight. All records were lost at the State Unemployment Office, occupying the second story, but fortunately duplicate records were on file in Boston.

*Fire spread to other buildings.

Jan. 25, New Castle, Del., S & L Enterprises, Inc., et al. $500,000; 1 killed

Sixty-six food, clothing and other retail sales concessions. At 7:05 A.M., while the watchman and four concessionaires were in the 500 ft. long by 65 to 125 ft. wide 1-story masonry, steel-framed building preparing for the noon opening, fire broke out at a doughnut machine. The LP-Gas burner for the machine flared up when it was lit and the flare ignited cooking oil in the machine and grease in the hood overhead. The machine operator attempted to put out the oil fire with two 2½-gallon water type extinguishers but when the water spread the fire he ran to the office to telephone the alarm. When heat broke a window beside the machine flames spread to canvas drops and awnings around the concessions, involved plywood

Wallace E. Huntington

Thirty-five large loss store fires originated in unsprinklered basements. This $750,000 fire at Springfield, Massachusetts was one of them.

Walt Mulcahy

. Three downtown buildings in Reno, Nevada were destroyed by two almost simultaneous gas explosions. The buildings had been evacuated previously. One of the two victims was a man standing on the sidewalk. The other was a building occupant who had gone back inside to get personal belongings.

partitions and raced through the building so rapidly that the occupants had to run to escape.

One of the men was in the men's room when the fire broke out and was trapped. The state fire marshal in his report commented that had the fire occurred during a normal operating period hundreds of people would no doubt have died in the fast spreading fire. The entire building was in flames when the first fire company arrived.

*Feb. 5, Reno, Nev., Biltz Building, et al. $2,000,000; 2 killed

Five store and office buildings. Two people were killed and 45 were injured when two almost simultaneous explosions (folfowed by fire) destroyed three downtown 1- and 2-story masonry, steel- and wood-joisted buildings. Ensuing fire also caused considerable damage to a 3-story brick mercantile building and two 1- and 2-story office buildings. Extensive damage to plate glass windows occurred within a 600 ft. radius.

At approximately 12:45 P.M. gas company and fire department representatives who were on the scene investigating a reported odor of gas in one of the buildings decided that the buildings in the area should be evacuated. This was accomplished before the explosion occurred at 1:03 P.M. One of the two victims was on the sidewalk; the other had reentered a building and was just stepping outside when the explosions occurred.

Following the explosion a break was discovered in a 2-inch propane-air distribution main in the street. Whether the break occurred before or after the explosion has not been determined.

July 29, Lodi, N. J., Frankie's Market $500,000

Three hundred food, clothing, appliance concessions. Fire, believed to have been set with gasoline, originated about 3:00 P.M. on an afternoon when the building was not in operation (it was open for business only two days a week). It burned at least 15 minutes before being seen by a neighbor and was spreading through crowded tables and benches for merchandise display in the undivided and unsprinklered 528 ft. by 120 ft. building when firemen arrived.

*Fire spread to other buildings.

*July 29, San Rafael, Calif., Wells Fargo Bank, et al. $1,000,000

Wide World

Twelve downtown 1-, 2-, and 3-story buildings. Fire that originated in a small wooden shed spread rapidly before a 15 mph wind to ten congested wooden buildings.

When one of the buildings collapsed into a 60-ft.-wide street the fire spread to two other buildings, one of reinforced concrete construction, on the other side of the street and downwind from the fire. The interior of the reinforced concrete building was burned out and the other building (combustible construction) was destroyed.

The fire was finally brought under control by firemen from 14 fire departments.

*Fire spread to other buildings.

Aug. 3, Essex, Md., E. & T. Realty Co., et al. $1,200,000†

Seven-tenant shopping center. The 365 ft. by 120 ft. 1-story brick, wood-joisted building was practically destroyed by fire that originated in a furniture storage section in the basement. Factors responsible for the extensive damage were lack of sprinkler protection, absence of masonry division walls, a blind attic that extended over practically the entire building and open stairways.

Discovery was made by a fire department member in a fire station across the street at 9:45 P.M. All stores except a drug store in the building had been closed since 9:00 P.M. Two pieces of apparatus responded promptly, and after some delay, firemen forced an entry into the basement via a rear loading door. Hose streams were directed from this opening but it was soon apparent that they were not reaching the fire effectively. In the meantime flames entered a basement corridor and spread through this corridor to all parts of the basement and extended to the first story by means of open stairways and by burning through the wood flooring of the first story. Fire fighters then decided the fire was out of control and asked for aid.

About two dozen hose streams were eventually placed in operation but since the fire had entered the undivided attic it was too late to save the building.

†Figure includes business interruption loss.

Wide World

Rows of stores such as this one at Essex, Maryland are sometimes described by the modern term "shopping center." Unfortunately, the shopping center often has the same structural fire protection weaknesses that have been associated with rows of stores for years.

Aug. 19, Spokane, Wash., Karl's Shoe Store, et al. $521,000†

Shoes, shoe repair, bakery, clothing store. Ignition of a wooden electric panelboard by a short circuit was the probable cause of fire that spread from the panelboard in the basement to the exposed wooden joists and under surface of first story flooring. An employee of a first story bakery smelled smoke at 9:34 A.M. and after an unsuccessful attempt to use the bakery telephone which had been put out of order by the fire he called the fire department with a neighbor's telephone.

Firemen tried to get at the basement fire, but by then the fire had reached a basement storeroom for a shoe repair shop and was generating dense smoke. Fourteen firemen were overcome trying to get at the basement fire.

Fire eventually burned up into the first story where smoke also became so thick that fire fighters were forced outside. Since there was no stairshaft or other vertical opening in that part of the building involved in the fire, it was necessary to chop holes in the second story flooring and the roof of the 2-story brick, wood-joisted building in order to ventilate the building. Firemen were then able to get inside and put out the fire.

In commenting on the fire, the fire chief said it was another example of the need for sprinklers in basements and that all of the big losses in recent years in Spokane have been from basement fires. Spokane has an ordinance requiring installation of sprinklers in basements, but building owners still have several years before they must comply.

†Figure includes business interruption loss.

Restaurants

March 29, York, Pa., Famous Restaurant, et al. $500,000; 1 killed

Restaurant, stores, offices, dental laboratory. Fire that originated during the night in the basement of the restaurant was not discovered until 1:04 A.M. when guests of a hotel next door smelled smoke. Firemen found fire out of control in the unsprinklered basement of the 175 ft. by 27 ft. 2-story brick, wood-joisted building and spreading up through the building. Delayed discovery, lack of sprinklers, nonfirestopped walls and ceilings, lack of division walls and the undivided attic were the principal reasons for the destruction of the building. A fire fighter suffered a fatal heart attack.

*May 29, Thetford Mines, P. Q., Bey Restaurant, et al. $565,000

Four buildings housing stores and apartments. Originating within a nonfirestopped partition in the first floor restaurant, fire was first discovered when heat ignited papers on the floor adjacent to the partition. Employees attacked the fire with buckets of water but the fire persisted and when it started to spread along the wooden and combustible fibreboard interior finish, they fled and notified the fire department.

Flames were coming from the roof of the 215 ft. by 70 ft. 3-story wooden building when firemen arrived. Fire spread to two wooden buildings on one side and one on the other before sufficient fire apparatus could be assembled to make an effective attack.

*Fire spread to other buildings.

Store Fires with Losses from $250,000 – $500,000

Clothing Store

*March 7, Marion, Ind., Price Hutchins Clothing Co. $374,500

Department Stores

Jan. 6, Romulus, Mich., Romulus Department Store, et al. $250,000

*Jan. 8, Freeport, Ill., Stuckenbergs Department Store, et al. $418,000

*Fire spread to other buildings.

April 3, Wenatchee, Wash., Miller's Department Store, et al. $322,000

May 13, Carbondale, Ill., Rechter Bros. Department Store $250,000

Sept. 20, Wheeling, W. Va., J. C. Penney Co. $321,500

Oct. 12, near Tucson, Ariz., Sprouse-Reitz Variety Store, et al. $300,000

Oct. 22, Milford, Conn., Russell's Discount Store $300,000

Furniture Stores

*Feb. 12, Los Angeles, Calif, Westside Furniture Store, et al. $264,000
March 13, Wilkes-Barre, Pa., Stoehr Furniture Co. $250,000
Aug. 4, Colonie Twp., N. Y., R. S. Ras Co. $350,000
*Sept. 13, Arkansas City, Kan., Parman Furniture Store, et al. $250,000
*Dec. 12, McMinnville, Tenn., Meyers and Oliver Furniture, et al. $350,000
Dec. 15, Wichita, Kan., Cardinal Home Furnishings $364,000
Dec. 21, Augusta, Ga., Rhodes Furniture Co. $275,000

Hardware Stores

*June 9, Scottville, Mich., Mattix Hardware and Furniture Store, et al. $300,000
Aug. 14, Reno, Nev., Nevada Auto Supply Co. $328,500

Jewelry Store

*Oct. 27, Trenton, N. J., Hamilton Jewelers, et al. $343,000

Multiple Occupancy Stores

*Jan. 17, Clare, Mich., Western Auto Store, et al. $260,000
*Jan. 29, Warren, Ohio, Market House Arcade, et al. $325,000
Feb. 17, Somerville, N. J., S & S. Stationers, et al. $297,000
Feb. 19, Fort Wayne, Ind., Meyer Bros. Drug Co., et al. $333,500
March 7, Yardville, N. J., Yardville Sales Center $300,000

*Fire spread to other buildings.

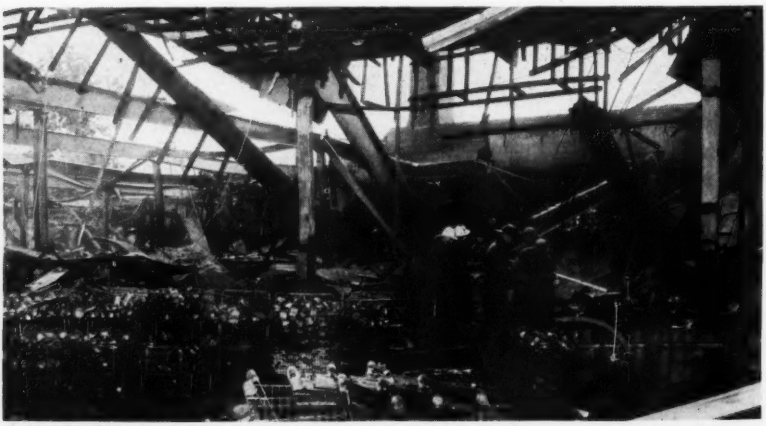
*April 2, Paramus, N. J., Riki California Corp., et al. $335,000
*April 4, Sanford, Fla., State Farmers Market $450,000
April 22, Riverside, Mo., Riverside Red X Market, et al. $250,000
*May 1, Catskill, N. Y., Catskill YMCA, et al. $275,000
June 22, Phoenix, Ariz., Balke Building $270,000
July 20, Long Beach, Calif., Plaza Shopping Center, et al. $305,000
*July 29, Toms River, N. J., Luria's Department Store, et al. $250,000
Dec. 12, Ormond Beach, Fla., Ellinor Village of Ormond Beach, Inc., et al. $292,000
Dec. 12, Spokane, Wash., Fall City Building $304,500
Dec. 24, Norfolk, Va., Withers Building Corp., et al. $331,000
Dec. 27, Kellogg, Idaho, Morrows Department Store, et al. $283,000

Restaurants

Jan. 24, Sheffield Twp., Ohio, Sheffield Restaurant, et al. $420,000
March 11, Pittsburgh, Pa., Joyce-McClement Restaurant, et al. $300,000
Sept. 27, Toronto, Ont., Guide Restaurant, et al. $400,000
Oct. 27, Penndel, Pa., Flannery's Restaurant $300,000
Dec. 8, Scranton, Pa., Preno's Italian Restaurant, et al. $250,000

Supermarkets

Jan. 23, Vineland, N. J., Acme Supermarket, et al. $450,000
June 26, Rockhill Village, Mo., National Food Stores, Inc., et al. $344,000
July 1, Warwick, Va., Rich's Supermarket $250,000



St. Louis Post Dispatch

Half an hour before closing time fire originated near the meat counter in this supermarket at Rockhill Village, Mo. The employees and ten customers left without injury as the fire extended to the combustible fiberboard ceiling and entered the concealed roof space.

Fifty-five Large Loss Warehouse Fires

The 55 warehouse fires in 1957 with individual losses of $250,000 or greater accounted for $29,835,500 loss. Comparative figures for 1956 were 50 fires and $29,661,000 loss.

The three deaths that occurred included a St. Paul, Minnesota fireman who suffered a fatal heart attack while fighting a brush warehouse fire, and two employees who were trapped in the second story of an electrical equipment warehouse at Oakland, California. The 89 nonfatal injuries that occurred during the 55 fires included 77 to firemen and 12 to warehousemen.

Three-fourths Not Occupied

Forty-one of the 55 fires occurred while no one was in the building. Since only eight of the 41 were provided with some kind of automatic fire protection and only twelve had watchman protection it is not surprising that detection was delayed in 35 cases.

Eight of Twelve Watchmen Failed

Of the twelve watchmen who were on duty when these 55 fires broke out, only four did what a well-trained watchman is expected to do, —discover the fire reasonably promptly and call the fire department without delay. Three watchmen discovered the fires in their early stages but then delayed giving the alarm until after singlehanded attempts to fight the fires with portable fire extinguishers. Of the five instances in which the watchman failed to discover the fire promptly, one was explained by the fact that the watchman patrolled outside the building only, one was because the watchman was expected to divide his time between watchman duties and other responsibilities in the building, and two were due to poorly laid out watchman routes that did not bring the watchman to the areas where the fires started. No explanation was given for the fifth instance of delayed discovery by a watchman.

Seven Warehouses Sprinklered

Seven of the 55 warehouses involved in large loss fires in 1957 were sprinklered (eight of 50 in 1956). Why was it that these seven sprinkler systems did not prevent large loss fires? The following explanations again emphasize the

Wide World

Ignition of combustible cargo by an overturned salamander started the fire that destroyed this terminal warehouse at Bridgeport, Conn. Open overhead loading doors on opposite sides of the building, and lack of sprinkler protection were notable factors in the destruction of this 1-story building.

fact that to be effective under all conditions a sprinkler system must protect the entire warehouse, water supplies must be strong, and the system must be maintained in operating condition. In addition, storage methods must be such that water from sprinklers can reach the fire.

The only partial sprinkler system involved in last year's large loss warehouse fires was installed in an electrical equipment warehouse in Cleveland. Originating in the unsprinklered 1-story section, the fire entered upper stories of the adjoining sprinklered 4-story section through plain glass windows and opened so many sprinklers in the two upper stories that more water was required than could be supplied. In a Chicago grain elevator poor water supplies and overloaded dry pipe valves rendered sprinklers ineffective; in a greeting card warehouse at Elmira, N. Y., the sprinkler system had been drained to prevent freezing; in a cotton warehouse at Humboldt, Tenn., there was insufficient water for sprinklers and hose streams; at Billings, Mont., high and solid piles of bagged sugar beet pulp prevented sprinkler discharge from reaching the fire in the pile; and at Henderson, N. C. improper storage methods in a cotton warehouse allowed fire to spread throughout the warehouse and open more sprinklers than could be supplied simultaneously. At Walpole, Mass., one sprinkler had put out a fire in baled rags at noontime. Two hours later, while the system was shut off awaiting replacement of the fused sprinkler, fire again broke out and this time destroyed the building.

Wide World

Failure to replace a sprinkler immediately after it had extinguished a fire resulted in destruction of this rag warehouse at Walpole, Mass. A second fire occurred two hours later while sprinklers were shut off.

One Automatic Fire Alarm System

Fire at the head of an elevator leg in a Maddock, N. D. grain elevator was detected by a partial automatic fire alarm system that protected the head house. A passerby heard the alarm bell on the building and summoned firemen who held the fire in check until their water supply gave out.

Thirty-six Multistoried Warehouses

Contrary to the experience of recent years more than half of the large loss warehouse fires in 1957 occurred in buildings more than one story high. In these multistoried buildings there were several construction features influencing fire spread that are not found in 1-story buildings. Of these the most frequently met were open stairways (18) open elevator shafts (13) and unprotected conveyor openings (5). One structural feature conducive to large loss fires that is prevalent in warehouses is excessively large areas. When these areas are filled with high concentrations of valuable contents and are not sprinklered, the results are apt to be disastrous when fire breaks out. Excessive fire areas were noted as factors responsible for the extent of damage in 31 of the 55 large loss warehouse fires.

Storage Methods

In 35 fires the way in which the contents was stored in the warehouse contributed to the spread of fire, prevented effective use of hose streams or rendered sprinklers ineffective. High piled stock was noted as a factor 17 times, poor stock subdivision 16 times and inadequate window or wall clearance 7 times.

Boat Storage**

*July 9, Seabrook, Texas, W. M. Muecke, et al. $500,000

Pleasure boat warehouse and pier; small retail stores. Originating in wrapping paper stored in the attic above a fish store, fire spread throughout the 240 ft. by 60 ft. 1-story steel-framed, metalclad building occupied principally as a pleasure boat warehouse. A watchman who made half-hourly tours of the boat warehouse and adjoining pier where several pleasure craft were moored discovered the fire at 9:15 P.M. His tour did not take him into the attic. Since the building was not sprinklered and since there were no masonry fire divisions, the fire was out of control in the attic when discovered. Fire spread to the wooden pier and to boats moored there. Exploding gasoline tanks on the boats caused the fire to spread rapidly from one to another.

Electrical Equipment Warehouses

Aug. 21, Cleveland, Ohio, General Electric Co., et al. $1,364,000

Fluorescent, incandescent, photography lamps; lamp-making machinery. The partially sprinklered 1- and 4-story building was severely damaged by fire that originated in the unsprinklered and unoccupied 1-story wooden section (formerly a truck repair garage). Vagrants were known to visit this 1-story area and are suspected of having set the fire. The adjoining 4-story brick, heavy timber constructed section was protected by central-station-supervised dry pipe sprinkler systems supplied from street mains. The 4-story section was heavily loaded with high piles of cartons of lamps in practically every available space above the basement. Old machinery was stored in the basement.

Outsiders reported the fire at about the same time that the central station received a trouble signal over the system supervising the sprinklers. Since the signal wires passed over the roof of the 1-story section, it is felt that the trouble signal was sent when fire broke through the roof. First arriving firemen found the 1-story section in flames and soon learned that the fire had entered the upper floors of the adjoining 4-story section through plain glass windows.

The fire is believed to have spread across the tops of the cartons in each story ahead of opening sprinklers which were corroded and thereby slow in fusing. Although the second pumper to arrive was connected to the fire department connection, the large number of sprinklers that opened required more water than could be supplied at adequate pressure.

*Fire spread to other buildings.

**See also page 252 for another boat storage fire story.

United Press

Fire shown here in the upper stories of this sprinklered 4-story section of a Cleveland, Ohio electric light warehouse originated in an unsprinklered 1-story section.

This was the case in the two upper stories where fire caused severe damage and burned off the roof. On lower floors sprinkler discharge was adequate with the assistance of fire department hose streams to check the fire before it had spread very far inward from the windows.

As all reports on this fire point out, failure to provide sprinkler protection in the 1-story section of the building was the outstanding weakness of the sprinkler protection.

Nov. 12, East Hartford, Conn., Radio and Appliance Distributors, Inc. $715,000

TV sets, radios, sewing machines, phonograph records. The basement and first story of this 10,080 sq. ft. 1- and 2-story brick, steel-framed building were burned out by fire that had made considerable headway in the unsprinklered basement before discovery by a policeman at 6:57 A.M. The fire originated in the service and repair areas from where it spread rapidly through the undivided basement, due to two layers of tar paper that had been fastened to the basement ceiling. Flames reached the first story (apparently via open stairways) where combustible partitions and congested and high-piled stock helped spread the fire.

Food and Groceries Warehouse

May 14, Bridgeport, Conn., First National Stores, Inc. $575,000

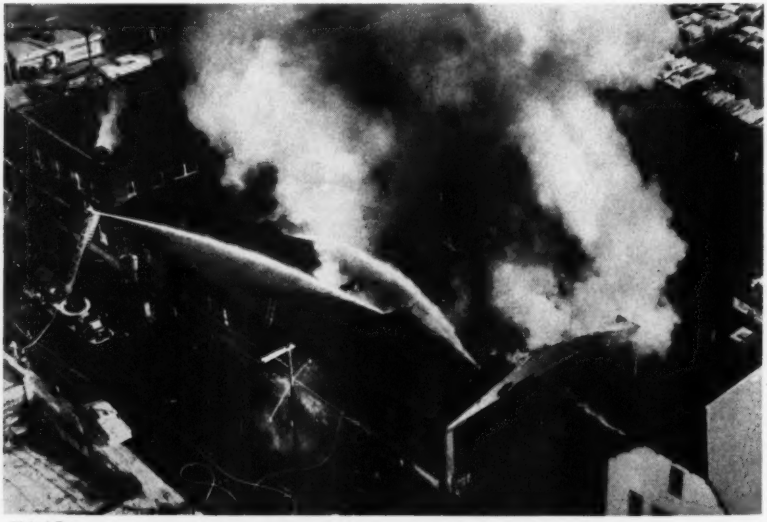
Fire that destroyed this 36,425 sq. ft. 1-story wooden warehouse originated in an empty freight car on a siding next to a building wall. Originating in paper wrappings and dunnage left in the car, the fire entered the unsprinklered warehouse through wire-mesh-covered openings in loading doors before discovery by occupants at 5:45 P.M.

After an unsuccessful attempt to check the fire in the building with portable extinguishers, one of the men telephoned the fire department. This delay allowed the fire to gain complete control of the interior of the undivided and unsprinklered warehouse before the first fire apparatus arrived. Windows blocked by high piles of stock, and locked doors further delayed fire fighting.

Grain Elevators

Jan. 21, Chicago, Ill., Continental Grain Co. $5,000,000

At 9:47 P.M. employees heard a waterflow alarm and on going to the riser location



United Press

With no automatic fire protection or watchman service provided for the electrical appliance warehouse at East Hartford, Conn., fire that originated during the night was not discovered until seen by a policeman at 6:57 A.M.

United Press

The largest warehouse loss of 1957 occurred in this sprinklered grain elevator in Chicago, Illinois.

found fire dropping down from above. While going to telephone the alarm they met apparatus that had been notified by an outsider. On his 9 P.M. tour of the elevator the watchman had noticed nothing unusual.

The fire burned furiously for over nine hours and despite the use of more than 70,000,000 gallons of water by the Chicago Fire Department, eventually destroyed this 70,000 sq. ft., 155-ft.-high brick and metal-clad elevator.

Cause of the fire and reason for failure of sprinklers to control the fire could not be determined. The discovery of several small fires in another elevator during the days subsequent to the fire suggested arson as a possible cause. The dry pipe valves on the sprinkler system were known to be overloaded and water supplies were poor — four 4,500-gallon pressure tanks, one 1,000 gpm automatic fire pump and one 1,500 gpm manual fire pump (not used). Since the basement was under water after the fire and later leveled off with fill, it was not possible to investigate the condition of piping and valves after the fire. In the absence of other evidence the failure of the sprinkler protection is being attributed to poor water supplies and overloaded dry pipe valves.

Aug. 17, 1957, Fulton, Ore., Pendleton Grain Growers, Inc. $548,500

A midnight fire, believed to have started from an unknown cause in an accumulation of grain dust in the 1-story attached scale house, was discovered by a homeward bound high school student as it broke through the windows. The short delay in getting a telephone line and the total delay of 45 minutes before the company-owned fire department arrived at this semi-isolated location allowed the fire to involve completely and destroy this 70-ft.-high, 275,000-bushel wooden grain elevator.

Additional factors contributing to this loss were: lack of watchman protection or alarm system, lack of adequate water supply (nearest adequate supply 8½ miles away), and undivided wooden construction.

Sudbury Daily Star

A noncombustible building and its noncombustible contents of hardware and plumbing supplies were destroyed in this $900,000 fire at New Sudbury, Ont.

Hardware Warehouse

July 18, New Sudbury, Ont., Taylor Hardware Co. $900,000

Destruction of a noncombustible building (steel framing, aluminum siding and roof) with noncombustible contents (hardware, plumbing supplies) probably seemed to be a remote possibility to the owners and may have accounted for their decision not to sprinkler the building. As it turned out, the combustible attic floor, stored papers in the attic, office furniture and supplies and combustible crates and cartons of stock provided adequate fuel to cause total destruction of the building.

The fire originated when sparks from a welding torch being used on the roof fell on papers stored in the attic. The fire burned an estimated 30 minutes before employees in the first story discovered it. Public fire fighting was ineffective due to poor water supplies, the nearest hydrant being 2,000 feet away.

Miscellaneous Storage

Jan. 14, St. Paul, Minn. Fuller Brush Co. $541,000; 1 Killed

Brushes, insecticides, cosmetics, spot removers, wax. Fire that destroyed the 135 ft. by 65 ft. 2-story brick, wood-joisted warehouse followed a gas explosion in a basement storage room. The explosion occurred when the foreman of a crew installing an automatic sprinkler system lighted his cigarette lighter. Cartons of brushes, boxes of insecticide bombs, spot removers, drums of floor wax and other combustible contents created an intense fire that burned for seven hours before being controlled. Acrid smoke that blanketed the area made fire fighting extremely difficult. One fire fighter suffered a fatal heart attack while fighting the fire.

It was the consensus that the gas leaked from a gas service pipe three feet below ground level. This pipe apparently had been damaged in some way when a large water pipe to supply the sprinkler system was installed six feet below ground level and directly beneath the gas pipe.

April 15, Toronto, Ont., Central Storage Co., Ltd. $2,000,000

United Press

Tires, canned food, cheese, antifreeze. The 23,600 sq. ft. 3-story brick, wood-joisted warehouse (formerly a brewery) was

destroyed by fire that broke out in the second story where 75,000 rubber tires were stored. No explanation has been given for failure of the building watchman to discover the fire before it had gotten out of control. Lack of sprinklers, open stairs and elevator shafts and dense smoke from the burning tires that felled firemen allowed the fire to spread unchecked through the undivided and heavily loaded building.

April 16, Jersey City, N. J., J. Leo Cooke Warehouse Corp. $573,000

B. J. Stevens

TV sets, rolled paper, plastics, spices. Lack of automatic fire protection and watchman service allowed fire to make considerable headway in the first story storage area before discovery by the watchman for a neighboring building at 2:38 A.M. Fire fighters were unable to make effective use of hose streams due to poor storage methods which included piling to ceilings and piling in front of windows and doors.

Flames spread up open stair and elevator shafts to all parts of the undivided 16,250 sq. ft. 5-story brick, wood-joisted building but were kept from an adjoining and communicating 5-story fire-resistive warehouse by double fire doors at openings in the fire wall between the two buildings.

Office Supplies Warehouse

*Jan. 2, Ottawa, Ont., By-Ward Market Area $640,000

Wide World

Typewriters and other office supplies storage; hotels, apartments, stores. Ten buildings were destroyed by fire that originated in the basement of an unsprinklered 200 ft. by 65 ft. 3-story masonry, wood-joisted office supplies storage building. Discovery was made by a cleaning woman at 6:45 A.M. Open stairs and elevator shafts near the point of origin and combustible fibreboard interior finish were structural weaknesses which, in conjunction with lack of sprinklers, accounted for the spread of fire through the building of origin. Absence of standard fire walls or adequate space separation of adjacent or communicating buildings of combustible construction was primarily responsible for the spread to exposed buildings.

Paper Warehouses

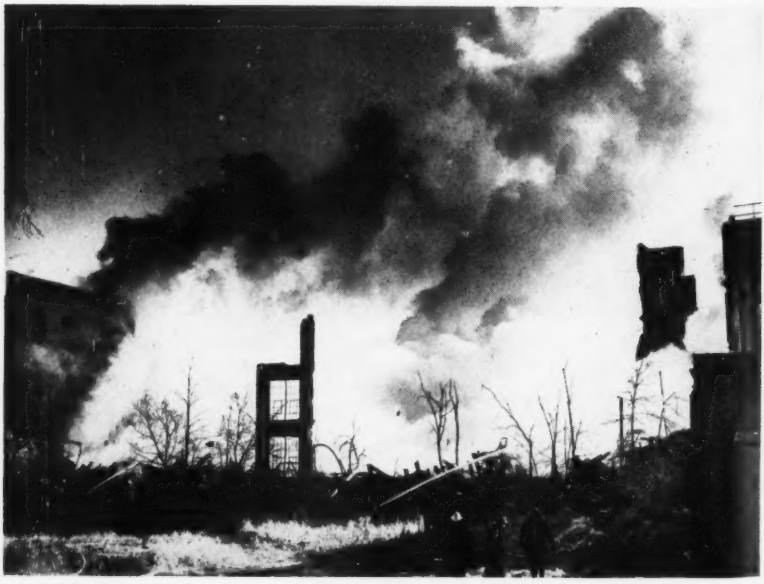
July 8, Green Bay, Wis., McDonald Lumber Co., et al. $1,390,000

Paper mill supplies, machinery, roll paper, paper products. This 1,000 ft. by 120 ft. unsprinklered 1-story concrete block, wood-joisted building and its contents were destroyed by fire that broke out in the mill supplies storage area near the center of the building. It had made considerable headway before discovery at 8:07 A.M. by employees in the paper storage area. The paper storage

*Fire spread to other buildings.

Green Bay Press-Gazette

Fire jumped the low parapet of the division wall that subdivided this unsprinklered 1000-ft.-long paper warehouse at Green Bay, Wisconsin (see page 271).



Elmira Star-Gazette

The sprinkler system for this greeting card warehouse at Elmira, New York had been shut off and drained to prevent its freezing (see page 273).

area was separated from the mill supplies area by a substandard concrete block division wall. After breaking through the combustible roof in this area of origin the fire jumped the low parapet on the division wall and entered the paper storage area.

All available fire apparatus and manpower responded but due to poor water supplies from hydrants fed by a 1½-mile-long 12-inch dead-end main only two hydrant-supplied lines could be laid to the fire. Fourteen hours later the fire was brought under control, by which time the building and contents were totally destroyed.

Aug. 7, Cleveland, Ohio, Cleveland Terminal Warehouse Co., et al. $500,000

Wide World

Newsprint rolls. The brick, wood-joisted building destroyed by the fire consisted of a 33,500 sq. ft. 1-story storage area and a communicating 2-story office area. Employees had been unloading newsprint into the building from box cars but about 20 or 30 minutes before the fire was discovered, the unloading operations had been stopped by the manager and all employees were sent to the office at the opposite end of the building to await further instructions.

The fire originated near the unloading dock but due to the distance of the employees in the office from this area and because of the intervening high piles of paper rolls it was not discovered at once. It is estimated that the fire burned 20 minutes before being noticed simultaneously by employees and outsiders. Flames spread rapidly over the large stock of rolled paper and also spread beneath the wood roof of the unsprinklered building. Three of the four sides of the building were accessible to fire fighters and water supplies were ample but because of high piles of rolls in front of windows and doors more water than would normally have been used was required to bring the fire under control.

In addition to fire damage suffered by the building there was considerable bulging of walls due to expansion of water-soaked newsprint that had been piled against the walls.

Dec. 5, Elmira, N. Y., Artistic Card Publishing Co. $1,000,000

Greeting cards. In 1955, when heat for this warehouse was discontinued, it was decided to shut off the sprinkler system during the winter months to prevent freezing rather than to convert the wet system to a dry system and thereby maintain sprinkler protection the year round. The fallacy of this decision became evident on Dec. 5, 1957 when the watchman of a neighboring plant looked over and noticed fire in the first story of the 4-story brick, wood-joisted building. Firemen responded promptly to the watchman's alarm but found that the fire had spread over oil-soaked floors, up open stairways and elevator shafts and had enveloped the entire building before their arrival. The chief knew the sprinkler valve was closed but because of the extent of the fire when he arrived decided it would be useless to turn on the sprinklers. Twenty-five minutes after the alarm was given the roof and floors collapsed.

Terminal Warehouse

April 18, Berlin, N. H., Lavigne's Red Wing Express Co., Inc. $500,000

Fire that destroyed the small unsprinklered 1-story concrete block, plank on exposed steel building occurred at 3:50 A.M. while employees were loading and unloading six large trailer trucks parked inside. The fire reportedly broke out when a light bulb was broken by a lift truck while moving a pile of rolled cotton gauze. Fire broke out on the gauze and spread to other combustible cargo, some in damaged cartons, as employees attempted to remove the trucks from the building. They drove out two before heat and fire forced everyone outside.

Firemen found the entire building in flames and used their very limited water supplies from a dead-end 6-inch main to protect a 1-story wooden building 10 feet away.

Warehouse Fires with Losses from $250,000–$500,000

Boat Storage

*May 5, Bolton Landing, N. Y., F. R. Smith and Sons, Inc. $250,000

Building Materials Warehouses

Feb. 13, Detroit, Mich., Coon DeVisser Co. $491,000

March 21, Atlanta, Ga., Carolina Lumber and Supply Co. $316,000

May 29, Milhurst, N. J., Milhurst Milling and Drying Co. $275,000

*Oct. 30, Patchogue, N. Y., T and S Lumber Co. $320,000

Dec. 31, Winnipeg, Manit., Muttart Builders Supplies, Winnipeg, Ltd. $400,000

Cotton Storage

*Jan. 16, Humboldt, Tenn., City Warehouse Co., et al. $300,000

March 22, Henderson, N. C., Standard Bonded Warehouse, Inc. $438,000

Department Store Warehouse

Sept. 25, Spokane, Wash., Bon Marché Department Store. $451,000

Drugs

*March 2, St. Louis, Mo., D-B Drug Co., et al. $276,000

Electrical Equipment Warehouses

*Jan. 22, Buffalo, N. Y., Davis Electrical Supply Co., Inc. $250,000

Jan. 23, Oakland, Calif., Pacific Gas and Electric Co. $300,000; 2 killed

*March 30, Centerville, Iowa, Iowa Southern Utilities Co. $356,500

April 18, Atlantic City, N. J., Kearns, Inc. $385,000

Oct. 28, Fairmount, Ind., Radio Corporation of America, et al. $370,000

Dec. 17, Louisville, Ky., General Electric Supply Co. $275,000

Food and Groceries Warehouse

Oct. 25, Washington Court House, Ohio, Cudahy Packing Co. $254,000

Furniture Warehouses

Jan. 12, Harrisburg, Pa., Harrisburg Storage Co., et al. $250,000

Jan. 26, Abington, Va., Vann's A & B Warehouse, et al. $275,000

Grain Elevators

Feb. 20, Maddock, N. D., Maddock Farmers Grain Co. $276,500

Feb. 21, Kansas City, Kan., Rodney Milling Co. $305,000

Oct. 24, near Ross, N. D., Ross Farmers Elevator Co. $409,500

Hay and Seed Storage

*May 15, Stockton, Calif., Paramount Seed Co. $335,000

*Aug. 3, near Lathrop, Mo., E. L. McGinness and Sons $290,000 (Hay)

Nov. 27, El Centro, Calif., Dessert Seed Co. $375,000

Miscellaneous Storage

Jan. 15, Billings, Mont., Great Western Sugar Co. $250,000 (Sugar beet pulp)

Aug. 19, Benwood, W. Va., Louis Marx and Co. $459,000 (Plastic and metal toys)

Oct. 13, Spokane, Wash., Goodwin Mayflower Storage Co. $269,500† (Chemicals, furniture, household appliances)

Nov. 10, Springfield, Ill., Burton M. Reid Co. $415,000 (Wholesale jewelry)

Dec. 30, Walcott, N. Y., J. H. Snyder Glads Co. $357,000 (Gladiolus bulbs)

Paper Products

May 17, Leaside, Ont., E. S. & A. Robinson Co., Ltd. $271,000 (Tissue paper in rolls)

Oct. 3, Akron, Ohio, Saalfield Publishing Co. $386,000 (Children's books)

Petroleum Products Storage

Feb. 12, Sillery, P. Q., Petroles Quebec, Inc. $263,000

Sept. 26, Wyoming Twp., Mich., Cornell Oil Co. $268,000

Rags

*Oct. 29, Walpole, Mass., P. Shaffer and Co., Inc., et al. $250,000

Rubber and Rubber Products Storage

Feb. 13, Moncton, N. B., Firestone Tire and Rubber Co., et al. $496,500 (Tires, chemicals, household appliances)

Dec. 26, South Gate, Calif., Firestone Tire and Rubber Co. $350,000 (Crude rubber, wax, sulfur)

Terminal Warehouses

July 10, Weehawken, N. J., Eazor Express Co. $250,000

Dec. 2, Bridgeport, Conn., Spector Freight Systems, Inc. $276,500

*Dec. 5, Utica, N. Y., Cartell and Gray Express Co., et al. $315,000

*Fire spread to other buildings.

†Figure includes business interruption loss.

Nineteen Large Loss School Fires

The 19 large loss school fires in 1957 caused property damage totaling $7,473,000 and resulted in 34 injuries, all to fire fighters. This experience is better than that of 1956 when 21 fires caused $9,033,500 loss.

Why did these 19 fires reach "large loss" proportions? The answers are the same as in 1956 or in any other year that has been studied — delayed discovery, lack of automatic fire protection, and the presence of certain construction weaknesses that show up repeatedly in the fire experience of combustible school buildings.

In all 19 fires discovery was seriously delayed. Twelve of the fires occurred when the buildings were unoccupied, two while classes were in session, and five when no classes were being held but one or more people were in the buildings, such as janitors or teachers. In the 12 fires that broke out when the buildings were locked up it is not surprising that detection was delayed since none of the 19 schools had automatic sprinkler protection or a central-station-supervised automatic fire alarm system. The seven other instances confirm what the large loss experience of other years has shown, namely, that the presence of someone in the school does not assure prompt discovery of a fire. These fires show that under all circumstances the only reliable guarantee that the fire will be discovered before it has spread beyond control is automatic fire protection.

A check of the 19 large loss school fires in 1957 revealed that all of the buildings were of combustible construction — wooden buildings or buildings with wooden interiors and brick exte-

Gordon Ward

One of the two large loss school fires to be discovered while classes were in session occurred in the Cloudland High School, near Roan Mountain, Tennessee. The 450 students did not know of the fire until they left the building under the supervision of their teachers.

rior walls. The same was true in 1956. The fact that a building is of combustible construction is not by itself sufficient evidence to predict that the building is likely to be destroyed if fire breaks out, but when the combustible building is not sprinklered and contains certain structural weaknesses that will permit a fire to spread rapidly from the point of origin the results are likely to be much the same as in the large loss fires of 1957. The 19 combustible buildings involved in these fires contained the following structural weaknesses: lack of division walls to subdivide large areas (17 cases), open stairways (8), concealed nonfirestopped spaces above ceilings (6), and nonfirestopped walls (6).

College

Aug. 25, Manhattan, Kan., Kansas State College $800,000

East Waters Hall (grain milling, laboratories, classrooms, offices). An hour and a quarter after the last watchman tour of this unsprinklered 5-story brick, wood-joisted building, a passerby saw flames coming from second story windows at one end of a wing. Cause of the fire could not be determined but may have been due to a faulty electric heater in the "hot room" on the first floor. This room was not checked by the watchman.

The fire spread vertically through an open stairway and grain elevator leg and broke through the roof, but apparently was being prevented from spreading laterally by fire department hose streams and a parapeted fire wall that divided the milling section from the rest of the wing.

Fire fighters had great difficulty in getting good hose streams in operation due to the poor water supply from 4-inch mains near the school. However, after long lines had been laid from pumpers located at distant hydrants, it appeared that the fire would be held in the milling section. Unfortunately, three hose lines were broken when automobiles ran over them and during the time taken to replace the broken hoses the fire jumped the parapeted fire wall and spread through the attic of the rest of the wing. A fire wall with all openings protected prevented fire from spreading from the wing to the main section of the building.

Primary and Secondary Schools

Jan. 17, West Hartford, Conn., Alfred Plant Junior High School $500,000

Junior high school. Fire apparently originated in the auditorium balcony, spread vertically through an air duct and mushroomed in the undivided attic of the unsprinklered 2-story brick, wood-joisted building. A janitor detected the fire at 6:52 P.M. A fire wall separated the section of the building housing the auditorium from a large classroom wing. Unprotected openings in the fire wall in the attic allowed fire to spread into the attic of the wing.

Feb. 25, Middletown Twp., Pa., Williamson Free School of Mechanical Trades $500,000

United Press

Trade school shops and classrooms. While most of the 134 students were in another building having lunch, fire was discovered in the second story of the U-shaped unsprinklered 2- and 3-story brick, wood-joisted shop and classroom building. The fire originated in a partition and had broken out in the second story when discovered. The school's student fire brigade attacked the fire with extinguishers and buckets of water for a few minutes, but when the fire started to spread rapidly everyone was ordered out. When firemen from neighboring towns arrived flames were coming from the roof and the building was beyond saving.

A short time before the fire the entire building had been rewired by the students under the supervision of the chief engineer. A wiring fault probably caused the fire.

March 21, East Williston, N. Y., Northside School $500,000

Primary grade school. An electric pottery kiln which apparently failed to shut off

Drennan Photo Service

automatically was the determined cause of fire that extensively damaged the unsprinklered 1-story brick, wood-joisted building. The fire originated in the art room in the basement. Smoke was noticed by residents of the area as early as 12:30 A.M., but it was 2:15 A.M. before a man walking his dog noticed the strong odor of smoke and traced it to the school.

Before arrival of firemen the fire in the basement art room had burned through the ceiling (combustible fibreboard acoustical tile on wood lath and plaster) and had entered the first story classroom directly above. Firemen found the building heavily charged with smoke and shortly after their arrival fire gas explosions blew out windows in the art room and classroom. Flames then spread rapidly into the concealed roof space and burned out of control until the roof collapsed. Fire was kept from most of the classrooms, gymnasium and auditorium although water damage in these areas was heavy.

September 26, Metuchen, N. J., Franklin High School $500,000

High school. Originating in the vicinity of the incinerator stack where it passed through the attic, fire spread through combustible storage in the undivided attic above the 3-story brick, wood-joisted original part of the school and into the attic of a newer wing by means of unprotected openings in the division wall.

United Press

Had recommendations been carried out that had been made to the School Board by a fire protection engineer in 1954, this $500,000 loss at Metuchen, N. J. would not have occurred.

In 1954 a fire protection engineer had made several recommendations to the school board to improve the fire safety of the building, including installation of sprinklers in the attic and installation of fire doors in the division wall openings in the attic. Neither of these recommendations had been adopted.

A physical education instructor who was in the school yard with a class first saw the fire. The school's fire alarm signal was rung and all 475 students marched out without incident, many believing a fire drill was in progress.

Oct. 8, Ottumwa, Iowa, Ottumwa Heights College and Academy $850,000

Parochial school for girls; convent. Fire that destroyed this unsprinklered U-shaped 3-story brick, wood-joisted building broke out in the attic of a wing while most of the students and faculty were at lunch in the basement of the main section. The fire was discovered by an occupant who was ill in bed in the third story dormitory of the wing where the fire started. Witnesses told firemen that smoke had been noted coming from the vicinity of the roof of the wing for at least 30 minutes before the alarm was given. Those who saw the smoke believed it came from the school's heating plant. Flames coming through the roof and from the top story ceiling when the first piece of fire apparatus arrived give further evidence that discovery was seriously delayed.

The extent of fire in the attic of the wing when firemen arrived, the poor water supply from the dead-end 6-inch main on the campus (less than 550 gpm available) and the lack of fire divisions in the attic were a combination of factors that made it impossible for the Ottumwa and mutual aid fire departments to prevent the fire from burning down through the building.

Ken Walker

Inadequate clearance between a furnace flue pipe and wooden flooring caused this fire at South Deerfield, Mass. The fire originated in the basement during the night and had spread to the attic before discovery by the janitor.

School Fires with Losses from $250,000 – $500,000

Jan. 8, Riverside, N. J., Washington Street School $400,000

Jan. 20, Southern Pines, N. C., U. S. Air Force Air-Ground Operations School $275,000

Feb. 1, South Deerfield, Mass., South Deerfield Regional School $250,000

Feb. 14, Ceredo, W. Va., Ceredo Junior High School $250,000

April 26, Savanna, Ill., Savanna Community High School $437,500

June 16, Lyons, Ind., Washington Township School $315,000

July 28, Wayne, Pa., Valley Forge Military Academy $250,000

Sept. 27, Albany, Ga., Hazzard Training School $250,000

Nov. 26, York Township, Ont., Silverthorn Public School $273,500

Dec. 9, Palmyra, N. J., Palmyra High School $345,000

Dec. 16, Roan Mountain, Tenn., Cloudland High School $250,000

*Dec. 23, Stillwater, Minn., Stillwater Senior High School $260,000

Dec. 30, Bluefield, Va., Bluefield Elementary School $267,000

*Fire spread to other buildings.

17 Hotel and Other Residential Large Fires

United Press

Girls getting in at 2:06 A.M. discovered fire in the fourth story of this college dormitory at Painesville, Ohio. Following an evacuation plan worked out by the fire chief and college authorities all occupants fled safely down fire escape stairs.

The 17 large loss fires in residential occupancies during 1957 occurred in eight hotels, five apartments, two dormitories and two private residences. Eight deaths (7 in apartments, 1 in a hotel), 51 injuries (34 to firemen, 17 to building occupants), and $10,324,500 loss were caused by these 17 fires. As bad as this experience is, it is better in all respects than that of 1956 when 24 large loss residential fires caused 11 deaths, 49 injuries and $11,765,000 loss.

In residential occupancies some means of prompt discovery of fire is essential as a life safety measure. It might be expected that delayed discovery would be a rare occurrence in buildings housing people 24 hours a day, but the record of this year's large loss fires shows that although 12 of the 17 buildings were occupied when the fires occurred, discovery was delayed in 14 cases. Many of these delays in discovery were due to the fact that 15 of the 17 fires occurred during the night when occupants are not likely to be up and about.

Automatic fire protection and standard watchman service are recognized methods of assuring prompt fire detection. It is significant that none of the 17 buildings was equipped with a complete sprinkler system, none had an automatic fire alarm and only one had a watchman. The one watchman (hotel at Sorel, P. Q.) made unsupervised and irregular rounds which probably explains why the fire was out of control when he discovered it.

Partial sprinkler systems were installed in the two dormitories involved in large loss fires, but unfortunately the fires did not originate in the areas where sprinkler protection was provided. At Joliette, P. Q., the fire originated in un-

sprinklered roof spaces formed when a mansard roof was constructed over the original peaked roof. Sprinklers in concealed spaces beneath the original roof operated but were out of range of flames spreading through unsprinklered spaces. Eventually the fire-weakened roof collapsed. At Painesville, Ohio fire originated in and destroyed the unsprinklered wing of a dormitory and spread to the attic of an adjoining sprinklered section, where no water discharged from sprinklers because fire fighters were using most of it to control the fire in the unsprinklered wing.

All except one of the buildings involved in these 17 fires were of combustible interior construction and in all except one (gas explosion in apartment at West Peoria, Ill.) the extent of damage was influenced by one or more construction features that made the buildings vulnerable to fire spread. Principal construction weaknesses were open stairwells (11), large undivided attics (5), nonfirestopped walls (5), combustible interior finish (5), concealed spaces above suspended ceilings (4), elevator shafts open (3) and substandard enclosure for elevator shafts (3).

Apartments and Stores

***Feb. 26, Meriden, Conn., Palace Block, et al. $702,500; 2 killed**

Apartments, stores, offices. Two occupants of fourth story apartments were trapped and killed by fire that broke out in the unsprinklered 4-story brick, wood-joisted building during the night. The fire originated in the rear of the basement at the foot of an open stairway and had spread up the stairway and was coming from the roof when firemen arrived at 1:48 A.M. Many of the occupants found hallways impassable because of smoke by the time they learned of the fire. Except for the two victims, however, all of those who were trapped in their apartments were rescued over ladders.

An adjacent 3-story brick, wood-joisted building was destroyed when fire entered through boarded-up windows in a wall.

*Fire spread to other buildings.

Nov. 23, Fairbanks, Alaska, Lathrop Building. $500,000; 1 killed

Apartments; radio and TV studios; newspaper publishing. A newsboy ignited a box

Robert J. Murray

In Meriden, Conn. two occupants of fourth story apartments were trapped by fire that originated in the basement at the foot of an open stairway.

of rubbish awaiting disposal in the second story hallway. The ensuing fire severely damaged the interiors of the three upper stories and caused lesser damage to the first story of this unsprinklered 4-story building (fire-resistive except for a wood roof). An occupant of a third story apartment lost her life.

The fire originated near an open stairway and a dumb-waiter shaft. It spread along the plywood wall finish of the stairway to upper floors and also entered and spread up through the dumb-waiter shaft and burned through plywood shaft doors at each story. A reinforced concrete slab at the top prevented ventilation of the shaft fire through the roof. Plywood wall finish and combustible fibreboard acoustical tile ceiling finish provided fuel for the fire in hallways. Fire entered apartments by burning through wood doors that opened into the corridor.

Investigators believe that the building's air circulation system contributed to the spread of fire to the first story corridors. A large fan in the basement took its air supply from corridors which served as return ducts of the air circulation system. Since the fan did not shut off it is felt that the downward flow of air accounted for the spread of fire along the combustible interior finish of the open stairwell to the first story. It is also possible that the air circulation system was in part responsible for the death of the victim, since it may be assumed that smoke and heat that were drawn from the corridors recirculated to rooms in the upper stories through air circulation system supply ducts.

When firemen arrived, several persons were waiting at upper story windows to be rescued. The department's 50-ft. ladder was used to rescue persons from one side of the building. Efforts to reach those on the other side with a 24-ft. ladder were futile and before the 50-ft. ladder could be relocated, one of the trapped was asphyxiated.

Dormitory

April 25, Joliette, P. Q., Joliette Seminary and Classical College $1,175,000

While welders were installing a new metal stairway fire broke out in an unsprinklered shallow roof space of the otherwise completely sprinklered 9,500 sq. ft. 5-story brick, wood-joisted building. Welding sparks were the probable cause. The welding crew attacked the fire with several fire extinguishers and the alarm was not transmitted until someone outdoors saw smoke pouring from the building. The fire spread through the unsprinklered parts of the roof space and although sprinklers operated in certain parts of the roof space and in the fifth story to protect these areas, they had no effect in the unsprinklered areas. Hose streams also were unable to reach the fire raging beneath the roof. Eventually the roof collapsed, breaking sprinkler piping in the fifth story and later the bell tower fell in and caused most of the building to collapse.

Hotels

March 22, Elko, Nev., Stockmen's Hotel $1,399,500

Wide World

The 17,500 sq. ft. unsprinklered 3-story brick, wood-joisted building housing a hotel, stores, gaming casino and offices was destroyed by fire that originated in the kitchen on the first floor. The fire originated in a pool of oil behind the oil-fired kitchen range and was discovered by the cook at 8:30 P.M. Employees attacked the fire with four soda-acid and two carbon dioxide extinguishers, but could not prevent flames from extending to the grease-covered walls and ceiling of the kitchen. Burning oil also flowed through a crack between the baseboard and floor and entered concealed wall spaces.

Open stair and elevator shafts, combustible fibreboard interior finish, concealed wall and ceiling spaces and weak water supplies were the principal factors responsible for the total loss. There was a large city reservoir but because of small street mains only three 2½-inch hoses reduced to five 1½-inch lines could be used.

Reports are silent on the number and distribution of guests when fire broke out but do state that all were evacuated without injury. Because of the open stairways and extent of fire when firemen arrived it is surmised that most of the guests were in first story public rooms.

Aug. 9, Portsmouth, Va., Monroe Hotel, et al. $1,017,500

The roof and top story of the unsprinklered 20,000 sq. ft. 5-story brick, wood-joisted building were destroyed by fire that originated in the concealed space between the roof and fifth story ceiling. Because of the extent of damage and the many violations of the Building Code, the 100-year-old building was ordered razed following the fire.

The fire was discovered by a fifth story guest at about midnight. There was a delay of several minutes in fire department notification while the night clerk investigated and then tried to notify the hotel manager before pulling a fire alarm box across the street. The fire was for the most part confined to the undivided roof space when firemen arrived, but open stairways and corridors were filling with smoke and several of the 60 hotel guests (the hotel occupied the three upper floors) were waiting at windows to be rescued. Others had escaped down an outside fire escape. Firemen removed several guests with aerial ladders and checked upstairs rooms to be sure that everyone had escaped.

The fire spread through the undivided roof space and also entered and spread through the fifth story. Firemen attacked the fire both with hose lines dragged up through the building and with outside streams and except in one location were able to keep the fire from involving lower floors. The fire in the top of the building had been brought under control when it was discovered that flames had spread down through a vertical concealed space (created

Wide World

Arson was the suspected cause of fire that destroyed the Columbia Hotel at Asbury Park, N. J. Firemen found doors and windows open and fires out of control on the first and fifth floors.

Elthan Durrant

Twenty minutes after smelling smoke the manager of this Simcoe, Ont. hotel investigated. On opening the door to the first story beverage room he was met by flames. On finding open stairways impassable, guests fled via outside escapes.

Mike Blizzard

Two adjacent unsprinklered wooden hotels in Atlantic City, N. J. were destroyed by a suspicious fire that occurred while the hotels were closed for the season. Combustible wall and ceiling finish, open stair and elevator shafts, concealed spaces and inadequate clear space between buildings were contributing factors.

when the building was remodeled) and had gained considerable headway in the concealed space at the first and second story levels. Before the fire could break out of this space it was extinguished.

Dec. 10, Montreal, P. Q., Windsor Hotel $1,850,000

630-room hotel. A Swiss fire alarm manufacturer heard a whispering noise in the newly-redecorated third floor hall as he left his room just 30 minutes after checking in. He noticed flames coming from some cardboard cartons stored in the hallway. After he had pulled the central-station-connected house alarm, he attempted to hold a position with a small-sized standpipe hose, but was soon forced to flee by the intense heat.

Upon the arrival of firemen, guests were waiting to be rescued from upper stories of the 6-story, stone, wood-joisted building. Thirteen guests were rescued by aerial ladders and many others were led down inside stairways by the fire fighters. The essential rescue work gave the fire a chance to spread rapidly through joist channels to an open pipe shaft which had recently been constructed in a former stairshaft. The fire spread up through this shaft and ignited the roof. Firemen attacked the fire that broke out at various floor levels adjacent to the shaft with 2½-inch hoses and got water on the roof fire by converting aerial ladders to water towers. After seven hours the fire was controlled, but by then the roof had been destroyed and the interior of the building had become thoroughly soaked.

United Press

Notably lacking were sprinklers and an automatic fire alarm system. Fire walls at both ends of the 250 ft. by 220 ft. L-shaped wing prevented spread to other sections of this block-sized structure.

Hotel and Other Residential Fires with Losses from $250,000 – $500,000

Apartment Buildings

*Jan. 16, West Peoria, Ill., John J. Heitzman, et al. $270,000

*Mar. 13, Sherbrooke, P. Q., Scheib Building, et al. $314,000

*Sept. 28, Chelsea, Mass., Leon Lewis, et al. $250,000

Dormitory

April 13, Painesville, Ohio, Lake Erie College. $360,000

Hotels

*Jan. 29, Sorel, P. Q., Hotel Chateau-Gai, et al. $437,500

*Feb. 19, Simcoe, Ont., Norfolk Hotel. $280,500

*Feb. 28, Asbury Park, N. J., Columbia Hotel, et al. $340,000

*March 1, Atlantic City, N. J., Merion Hotel, et al. $300,000

*March 3, St. Joseph, Mo., Jerome Hotel, et al. $491,000

Private Dwellings

March 6, Laurel Hollow, N. Y., Thomas Hilton. $250,000

April 15, Victoria, B. C., Government House. $387,000

*Fire spread to other buildings.

Fifteen Church Fires — $6,358,500

Francis Vogt

Fire in this 90-year-old church at Hornell, N. Y. was in many respects typical of bad church fires. Recent extensive renovation had not included installation of automatic fire protection. Consequently when fire broke out in the basement during the night it was not discovered until seen by a passer-by at 6:01 A.M. Before then flames had spread within nonfirestopped walls to the roof.

There were 15 church fires in 1957 resulting in individual losses of $250,000 or more. Fourteen "large loss" church fires occurred in 1956 but whereas the 1956 aggregated loss was $9,787,000, the 1957 over-all loss was $6,358,500, a 35 per cent decrease. No lives were lost in the 1957 fires but 28 firemen were injured while fighting them.

As was brought out in a recent NFPA study of church fires* the outstanding feature of bad fires in this occupancy is the fact that they are usually not discovered promptly. Ten of the 15 largest fires of 1957 occurred when the churches were unoccupied. This fact, in conjunction with the lack of automatic fire protection — sprinklers, automatic fire detection system — meant that in these 10 fires there was no possibility of their being discovered until someone entered the building or until they were seen by a passerby. Even the presence of someone in the building is no guarantee that the fire will be discovered promptly, evidenced by the fact that discovery was delayed in four of the remaining five cases although in each instance someone was there (roofers, painters, church clerk). In the only instance where the fire was discovered promptly, the roofer whose torch started the fire delayed calling the fire department until after he had spent vital time in an unsuccessful attempt to put out the fire on the roof with portable fire extinguishers.

*NFPA No. 56-4, Occupancy Fire Record – Churches.

Structural fire protection weaknesses again showed up in the "large loss" fire experience. In eight cases fire spread through concealed nonfirestopped spaces in walls, in five instances it spread through similar spaces above ceilings and in five cases absence of fire divisions in attics allowed the fire to spread above the entire church.

Four of the fires were caused by torches (2 painters' torches, one roofer's torch, one plumber's torch used to thaw pipes). Wiring faults (2 cases) were the only other known cause to occur more than once.

Jan. 14, Montreal, P. Q., St. Elizabeth du Portugal Church $802,500

Fire that originated in the basement from an undetermined cause destroyed the 140 ft. by 56 ft. 1-story stone, wood-joisted church. The principal factor responsible for the total loss was delayed discovery which in turn was due to the absence of automatic fire protection or watchman service. Answering a passerby's alarm at 4:29 P.M. firemen were confronted with a fire that required thirty 2½-inch hose streams to control.

*Jan. 15, Syracuse, N. Y., First Methodist Church, et al. $985,500

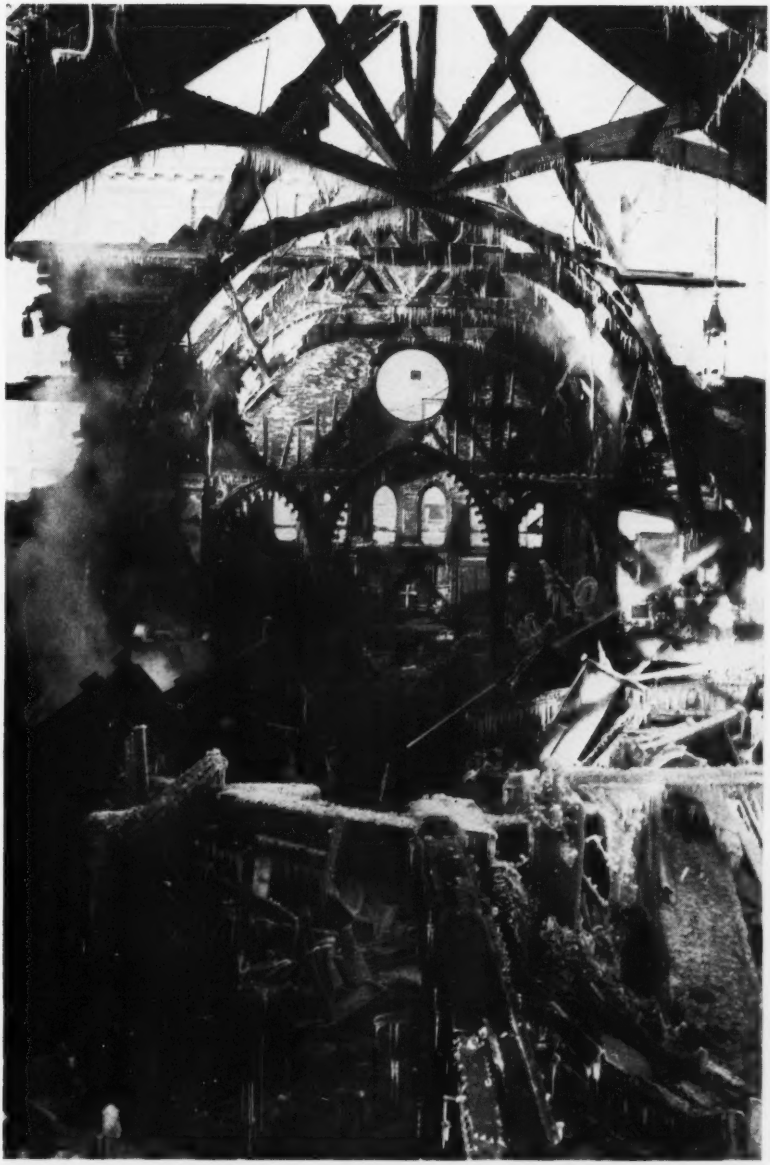
Church, church publishing house, church headquarters. Three adjoining and communicating church buildings were destroyed by fire that originated in the space between the first floor and basement ceiling of the church. The fire spread through the undivided basement, up through the church and into adjoining buildings as firemen fought in biting cold weather to save less seriously exposed buildings.

The fire was out of control when discovered by a passerby at 5:15 P.M. Fire department investigation traced the fire to a plumber's torch that had been used earlier in the day to thaw water pipes in the basement.

*Fire spread to other buildings.

Wide World

Four of the 15 large loss church fires, including this $985,500 fire at Syracuse, N. Y., were started by torches, — in this case a plumber's torch.



Journal-Star

Firemen were called at 3:30 A.M. to fight fire in this church at Lincoln, Nebraska. Flames were coming from windows and it was evident that the fire had been burning for some time before discovery. Destroyed with the church was a complete music library, many autographed and rare manuscripts, the complete works of Bach and a new church organ. No automatic fire protection had been provided to protect this building and its contents.

Jan. 23, Tuskegee, Ala., Tuskegee Institute $707,000

2,500-seat college chapel. During a severe electrical storm lightning struck the roof of the 1-story brick, wood-joisted building. Since no lightning protection was provided, fire broke out in the unsprinklered attic where it burned an estimated 40 minutes before discovery by a student passing the building at 12:20 A.M. The fire was then out of control and roof timbers started to fall in a short time later.

Since there was no criticism of the campus watchman it must be assumed that the origin and rapid development of the fire occurred between two of his hourly rounds of the building.

Dec. 12, Westmount, P. Q., Temple Emanu-El $527,500

At 11:20 A.M. a secretary at the church smelled smoke and telephoned the alarm. Firemen found fire spreading beneath the flooring of the first story and traveling within walls of the 3-story brick, wood-joisted building. The concealed fire could not be attacked readily and eventually broke through the roof.

Church Fires with Losses from $250,000 – $500,000

Jan. 10, Lincoln, Neb., Holy Trinity Episcopal Church. $250,000

Feb. 5, Kingston, Pa., First Methodist Church of Kingston. $350,000

April 17, Pen Yan, N. Y., First Presbyterian Church. $259,000

July 2, Lititz, Pa., Moravian Church. $250,000

July 11, Yamachiche, P. Q., Ste. Anne's Roman Catholic Church. $319,000

July 16, Hornell, N. Y., Christ Episcopal Church. $350,000

*Sept. 12, Mt. Clemens, Mich., St. Peter's Roman Catholic Church. $260,000

Sept. 14, Emporia, Kan., First Methodist Church. $360,000

Nov. 6, Rochester, N. Y., St. Boniface Roman Catholic Church. $300,000

Nov. 7, Pawtucket, R. I., First Baptist Church. $268,000

Dec. 28, Shelton, Conn., Episcopal Church of the Good Shepherd. $370,000

*Fire spread to other buildings.

Wide World

A painter's blowtorch started fire at a wooden cornice at this Lititz, Pa. church. The painter delayed calling the fire department until after he had discharged two carbon dioxide extinguishers (suitable for Class B and C fires) on the Class A fire.

Large Loss Aircraft Fires of 1957

Two hundred and twenty-two persons lost their lives in the 62 aircraft fire accidents reported in the following listing. The accident of Nov. 8 has not been fully investigated and the significance of fire as a contributing factor is thus not verified. Damages totalled $108,665,000, to average about $1,750,000 per accident.

Large Loss Aircraft Fires of 1957

1957 Date	Place	Type Accident	Operator	Type Aircraft	Estimated Loss	Number Killed Aboard Aircraft	Killed On Ground
Jan. 3	nr. Charlemont, Mass.	EF	USAF	F-86D	$ 700,000	1	0
Jan. 10	nr. Limestone AFB, Me.	EF	USAF	B-52D	$6,500,000	8	0
Jan. 10	Bergstrom AFB, Texas	CF	USAF	KB-29	$ 750,000	6	0
Jan. 14	Long Beach, Calif.	FF	USMC	AD-5	$ 260,000	1	3
Jan. 17	nr. Eielson AFB, Alaska	CF	USAF	WB-29	$ 750,000	12	0
Jan. 19	Naval Air Station, Seattle, Washington	CF	USN	R5D	$ 500,000	0	0
Jan. 22	nr. Willow Run Airport, Michigan	CF	USN	R5D	$ 500,000	1	0
Jan. 28	nr. Elmendorf AFB, Alaska	FF	USAF	C-124	$2,500,000	0	0
Jan. 31	nr. Langley AFB, Va.	CF	USAF	F-94	$ 700,000	2	0
Feb. 1	Rikers Island, New York, N. Y.	CF	NEA	DC-6A	$1,500,000	20	0
Feb. 1	nr. Gloucester, Mass.	FF	USAF	B-47	$2,500,000	4	0
Feb. 1	Mountain View, Calif.	CF	USAF	F-84G	$ 250,000	1	0
Feb. 2	nr. Miramar NAS, Calif.	EF	USN	F7U	$ 750,000	1	0
Feb. 2	L. G. Hanscom Field, Bedford, Mass.	CF	USAF	F-86F	$ 700,000	1	0
Feb. 21	Hertford, N. C.	CF	USN	F3H-2N	$ 750,000	1	1
Mar. 2	March AFB, Calif.	CF	USAF	B-47B	$2,500,000	4	0
Mar. 3	nr. Moody AFB, Ga.	CF	Mass. ANG.	F-94A	$ 700,000	2	0
Mar. 4	nr. Esler Field, La.	CF	USAF	F-84F	$ 250,000	1	0
Mar. 5	NAF Weeksville, Elizabeth City, N. C.	CF	USN	ZSG-3	$1,190,000	0	0
Mar. 6	Bancroft, Ontario	CF	RCAF	H-21	$ 500,000	0	0
Mar. 7	Lake Charles AFB, La.	GF	USAF	2-B-47's	$5,000,000	0	0
Mar. 16	nr. Miramar NAS, Calif.	CF	USN	FJ3	$ 250,000	1	0
Mar. 22	nr. Pinecastle AFB, Fla.	CF	USAF	B-47	$2,500,000	4	0
Mar. 29	nr. Skeatock, Kansas	EF	Boeing	B-52	$8,000,000	2	0
Apr. 1	nr. Otis AFB, Mass.	CF	USAF	T-33	$ 250,000	0	0
Apr. 2	nr. USNAS Chincoteague, Va.	CF	USN	P2V-6M	$ 500,000	11	0
Apr. 3	nr. Cherry P. MAS, N. C.	CF	USMC	FJ3	$ 250,000	1	0
Apr. 6	Lincoln AFB, Neb.	CF	USAF	B-47	$2,500,000	0	0
Apr. 12	USNAS, Brunswick, Me.	CF	USN	P2V-5F	$ 500,000	6	0
Apr. 26	nr. Monroe, Mich.	CF	USN	AD-4NA	$ 250,000	0	0
Apr. 30	Friendship Airport, Baltimore, Md.	CF	PAA	DC-7C	$1,500,000	0	0
May 8	nr. Otis AFB, Mass.	CF	USAF	F-84	$ 665,000	1	0
May 9	nr. Honolulu, Hawaii	FF	USN	P2V-6M	$2,000,000	0	0
May 24	nr. McChord AFB, Wash.	CF	USAF	F-102A	$1,300,000	1	0

(Continued on Page 293)

United Press Photo

Smoke inhalation and burns were blamed by the New York City Medical Examiner for the 20 deaths in this crash of a Northeast Airlines DC-6A on February 1, 1957 on Rikers Island. The Civil Aeronautics Board in their report "expressed concern" over the difficulties experienced in evacuating the passengers after the aircraft came to rest and noted that the fatalities and serious injuries were caused by the intense fire following impact. NFPA No. 403 recommends aircraft rescue and fire fighting services for airports.

Wide World Photo

Radio communication between the tower and crash crewmen was important in speeding response to this accident at the Seattle Naval Air Station on January 19, 1957. The R5D was first reported to have crashed in the water off the end of the runway but this was subsequently corrected by radio. Crash equipment was thus repositioned and the first unit was on the scene within 15 seconds after the aircraft came to rest. The 46 persons aboard escaped unassisted as fire engulfed the transport which inverted following right gear failure. Navy crash units, an MB-1 and two FFN-3's, extinguished the fire within 2 minutes using about 7,800 gallons of made-foam, including that applied as a protective blanket. In the Navy's words "well done."

Associated Press Wirephoto

Ignition of JP-4 fuel vapors occurred while the booster pump in the left aft center main fuel cell of this B-47 was being removed by ground crew personnel on March 7, 1957. The ignition source could not be determined. The fire was followed by an explosion in the fuel cell which produced an upward force which peeled and rolled back the wing skin surface and ruptured the cells forward and aft of the exploding cell. The burning fuel and explosions spread fire to an adjacent B-47. The fire department at the Lake Charles Air Force Base, La., used almost 2,000 gallons of foam concentrate, 91,000 gallons of water and 6,000 pounds of low pressure carbon dioxide in securing extinguishment, complicated by fire which extended to ramp drainage pipes and ignited magnesium parts of the aircraft.

At the Lincoln Air Force Base in Nebraska on April 5, 1957 a B-47 veered off the runway onto soft dirt while landing. A fire originated in the bomb bay section and spread rapidly through the nose section of the $2,500,000 aircraft. Five major crash trucks (2 USAF Type O-11A's, 3 USAF Type O-10's) and supporting fire equipment available at the base were in service with 78 fire fighters. One O-11A on standby reached the scene first but the pumping engine would not start. The loss was virtually total as magnesium fires could not be controlled with the foam used in the extinguishment efforts.

Nose gear retraction during a normal take-off was responsible for this accident involving a DC-7C of Pan American World Airways at Friendship International Airport in Baltimore, Md. on April 30, 1957. Fires started in the engine nacelles after the impact of the rotating props with the runway and spread after an explosion in one engine. This accident and a number of others during 1957 showed the value of airport fire services even where the impact conditions presented severe fire potentials. Fuel spillage in this case totalled 1,500 gallons from broken fuel lines and integral tanks. Following extinguishment about 500 gallons of fuel remained unburned. Two of the six crew members were forced to jump to the ground from the aft main cabin door as flames blocked the forward exit and heat prevented using the emergency chute at the main door. It is fortunate that no passengers were aboard. Full details are reported in NFPA Special Aircraft Accident Bulletin, Series 1957; No. 2 (available from NFPA for 25 cents).

(Continued from Page 289)

1957 Date	Place	Type Accident	Operator	Type Aircraft	Estimated Loss	Number Killed Aboard Aircraft	Number Killed On Ground
June 14	Charlotte, N. C.	CF	USAF	F-84G	$ 300,000	0	0
June 25	USNAS, Norfolk, Va.	CF	USN	F2H2	$ 400,000	0	0
June 28	Miami, Florida	GF	EAL	DC-7B & Constellation	$3,500,000	0	0
July 18	nr. Abilene Kansas	CF	USAF	B-47	$2,500,000	4	0
July 18	nr. Port Kent, N. Y.	FF	USAF	KC-97G	$1,000,000	5	0
July 18	Worcester, Mass.	CF	N.H. ANG.	T-33	$ 250,000	2	0
Aug. 9	Forbes AFB, Kansas	CF	USAF	RB-47E	$2,700,000	0	0
Aug. 14	Grand Prairie, Texas	FF	USN	F9F6	$ 250,000	0	1
Aug. 28	nr. Hereford, Texas	FF	USAF	KD-50	$1,500,000	0	0
Aug. 31	nr. Biggs AFB, Texas	CF	USAF	C-124	$1,600,000	5	0
Sept. 3	nr. Lambert-St. Louis Municipal Airport, Mo.	FF	USN	F3H2N	$ 750,000	1	0
Sept. 3	Danbury, Texas	FF	USAF	B-66	$1,000,000	0	0
Oct. 9	nr. Orlando, Florida	FF	USAF	B-47	$2,500,000	4	0
Oct. 9	nr. USNAS, Alameda, Calif.	CF	USN	F2H3	$ 500,000	0	0
Oct. 11	Homestead AFB, Florida	CF	USAF	B-47	$2,500,000	4	0
Oct. 29	nr. Falun, Kansas	CF	USAF	B-47	$2,500,000	3	0
Nov. 6	Castle AFB, Calif.	CF	USAF	B-52	$6,500,000	0	0
Nov. 8	nr. Honolulu, Hawaii	CF(?)	PAA	Strato-cruiser	$1,000,000	44	0
Nov. 14	USNAS Patuxent River, Md.	CF	USN	HR2S-1W	$2,000,000	2	0
Nov. 28	Miami International Airport, Miami, Fla.	GF	NAL	DC7B	$1,000,000	0	0
Dec. 4	nr. Eglin AFB, Fla.	EF	USAF	B-47	$2,500,000	3	0
Dec. 5	nr. Langley AFB, Va.	FF	USAF	F-100	$ 750,000	1	0
Dec. 9	nr. Corpus Christi, Texas	FF	USN	P5M-1	$1,000,000	8	0
Dec. 12	Fairchild AFB, Wash.	CF	USAF	B-52	$6,700,000	8	0
Dec. 13	nr. Duluth, Minn.	CF	USAF	B-47	$2,500,000	3	0
Dec. 18	nr. Palomar, Calif.	CF	USAF	B-47	$2,500,000	5	0
Dec. 18	Turner AFB, Ga.	CF	USAF	F-100D	$ 750,000	1	2
Dec. 23	nr. Honolulu, Hawaii	CF	USN	WV-2	$7,500,000	19	0

Key to Abbreviations

AFB — Air Force Base
ANG — Air National Guard
CF — Crash Fire
EAL — Eastern Air Lines
EF — Explosion in Flight
FF — Flight Fire
GF — Ground Fire
NAL — National Airlines
NAS — Naval Air Station
NEA — Northeast Airlines
PAA — Pan American World Airways
RCAF — Royal Canadian Air Force
USAF — United States Air Force
USMC — United States Marine Corps
USN — United States Navy

Wide World Photo

A DC-7B owned by Eastern Airlines struck a parked Eastern Super-Constellation while the former was being taxied on the ramp at Miami International Airport on June 28, 1957. The impact resulted in failure of the left wing of the DC-7B and damage to the tail section of the Connie. Fire followed immediately as wing fuel tanks on the DC-7 failed and flames spread to the Constellation. The resultant loss is estimated at $3,500,000 plus the loss of use of both aircraft capable of carrying over 80 persons each. Fortunately, the accident occurred when only flight crews were aboard the aircraft involved and all those aboard escaped unassisted.

Wide World Photo

While standing by for a KC-135 emergency landing at the Castle Air Force Base on Nov. 7, 1957 at 1656, the tower notified the crash crews that a B-52B had crashed following gear failure during a landing. Ten airmen aboard escaped unaided, two suffering burn injuries. The fire completely destroyed the $8,000,000 aircraft as 50 fire fighters used over 4,000 gallons of foam concentrate, 92,000 gallons of water and 4,000 pounds of carbon dioxide to complete extinguishment.

Seventy-one Other Large Loss Fires in 1957

There were seventy-one large loss fires in 1957 that involved occupancies that do not fall within any of the broad occupancy groups reported elsewhere in this issue of the QUARTERLY. These seventy-one fires caused $67,932,000 loss, 21 deaths (1 fireman, 20 others) and 163 injuries (120 firemen, 43 others).

The occupancies in which these seventy-one fires occurred were the following: one anti-aircraft installation, one armory, one auditorium, four bowling alleys, four buildings under construction or being demolished, one country club, one courthouse, sixteen forest fires, six garages, one gas compressor station, one gas well, one greenhouse, two hangars, two laundries and dry cleaning plants, seven lumber yards, one motion picture studio, eight office buildings and banks, three piers, two roundhouses, four ships and barges, one television studio and three vacant buildings.

Of the buildings involved in these 71 fires only one had automatic fire protection. The building under construction at Algoma Township, Ontario was protected by a sprinkler system but prior to the fire the sprinkler contractor had disconnected the temporary water supply while additions were made to the system, after which no one thought to reconnect the water supply.

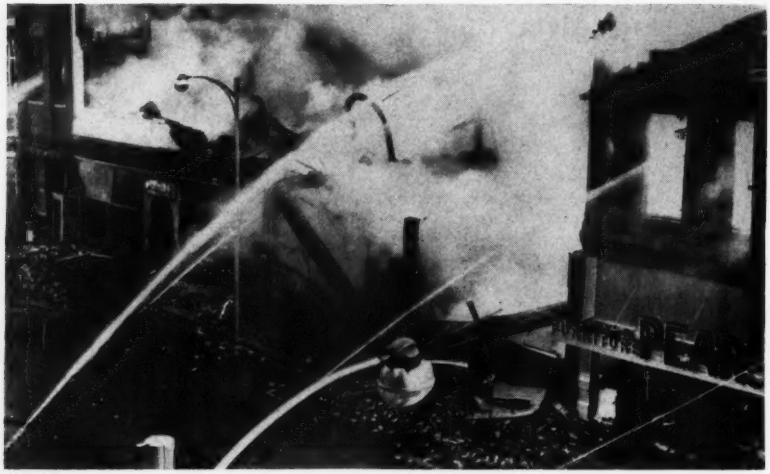
Anti-aircraft Installation

June 3, near Seattle, Wash., Washington State National Guard. $600,000

Anti-aircraft battery. Fire of unknown cause destroyed the 300 sq. ft. wooden communication center building in which it originated and two truck trailers filled with expensive radar and other equipment parked beside the building. When discovered at midnight by the site caretaker who lived in another building, the fire had made considerable headway. Before fire apparatus ar-

United Press

One of four "large loss" fires that involved bowling alleys in 1957 occurred at Saratoga Springs, N. Y. Flames spread to five other buildings due to plain glass windows in exposed buildings and absence of parapets on party walls. **(See report on page 296.)**



United Press

At Anderson, Ind., fire spread within concealed wall and ceiling spaces of this 2-story building housing bowling alleys, lodge rooms and stores.

rived flames had extended to the magnesium-constructed truck trailers and both vehicles were burning furiously. No water except that carried in fire apparatus was available for fire fighting.

Bowling Alleys

*Jan. 27, Saratoga Springs, N. Y., Palace Recreation, et al. $1,100,000; 1 killed

Six buildings housing stores, offices, apartments. Six 3- and 4-story brick, wood-joisted buildings in the business section of Saratoga Springs were destroyed by fire that originated in the rear of bowling alleys occupying the first story of one of the buildings. A taxi driver discovered the fire at 4:58 A.M. Delayed discovery of the fire, weak initial response of fire apparatus and manpower, and a half-hour delay in requesting additional help appear to be responsible for the spread of fire throughout the unsprinklered 3-story brick, wood-joisted building of origin. Plain glass windows in exposed walls and a lack of parapeted fire walls resulted in destruction of five adjoining or adjacent buildings. A policeman was killed when struck by a wall blown out by a fire gas explosion.

*Feb. 13, Anderson, Ind., Anderson Bowling Center, Inc., et al. $624,000

Bowling alleys, lodge hall, furniture store, tavern. An unsprinklered 2-story brick, wood-joisted building was destroyed by fire that originated in a concealed wall or ceiling space in a bowling alley occupying the first floor. Bowling alley occupants smelled smoke at 11:00 P.M. but could not locate the source and did not call the fire department. Two-and-a-half hours later an apartment occupant in an adjoining building was awakened by smoke and gave the alarm.

Firemen found flames at one end of the first and second stories and soon appeared to have the fire under control only to discover that it was spreading within walls and above ceilings to all parts of the 2-story building. Before being controlled fire jumped 12-inch parapets on party walls and ignited the roofs of the buildings on either side.

Aug. 20, Jenkintown, Pa., Jenkintown Bowling Alleys, et al. $628,000

Bowling alleys, newspaper publishing. Employees reporting for work in the newspaper plant on the first floor saw smoke coming from second story windows of the

*Fire spread to other buildings.

unsprinklered 150 ft. by 75 ft. 2-story brick, wood-joisted building. Firemen found fire out of control in the second story and before they could bring it under control, the roof had been destroyed. The fire was kept from the first story, although water damage to presses and other equipment was heavy.

Investigators determined that the fire originated in a storeroom where cartons of new pins were stored. Short circuit of wiring was the probable ignition source.

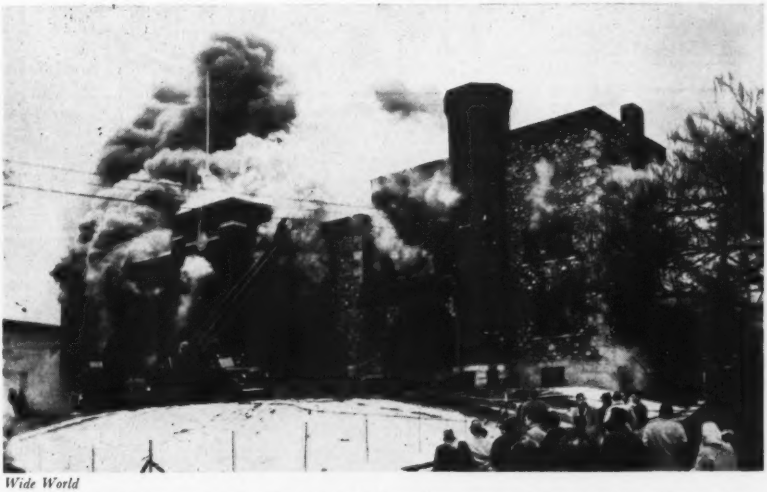
Buildings under Construction

June 13, Bloomfield Twp., Mich., Kirk-in-the-Hills Presbyterian Church. $750,000

Church under construction. The roof of this 14,500 sq. ft. masonry building was destroyed by fire that broke out as construction, that had been going on for eight years, was nearly completed. The roof consisted of lead-coated copper sheathing on 2-inch-thick wood planks on exposed steel beams with 1¼-inch-thick combustible fibreboard insulation attached to the under side of the roof planks. Lightning rods installed on towers at the four corners of the building had not as yet been bonded to copper downspouts, and the downspouts had not as yet been connected to ground rods.

International News

It is believed that lightning started a smoldering fire in the roof planks and fibreboard insulation during a noontime thunderstorm. The fire was not discovered until seven hours later when a neighbor saw smoke rising from the roof. Scaffolding (wood planks on tubular steel supports) that filled the interior of the church, interfered with effective use of hose streams. Before the fire could be controlled flames had destroyed most of the scaffold planking.



Wide World

A $300,000 fire occurred at the National Guard Armory at Nashua, N. H. The fire originated at an electrical outlet in the first story and was discovered at 9:59 A.M. when a fire gas explosion attracted the attention of an outsider. Two hours earlier the watchman had gone off duty.

United Press

A cutting torch started a fire in a 6-story building being demolished in New York. Fire was confined to the building until it collapsed. Flames then spread to surrounding tenements.

Nov. 27, Algoma Twp., Ont., Stanleigh Uranium Mining Corp., Ltd. $2,250,000†

Uranium concentration. Construction of the 97,000 sq. ft. 2-story steel-framed, wood-clad building had been completed and most of the equipment had been installed when fire destroyed about one-third of the wood roof and damaged concentration tanks, piping and other equipment beneath the burned roof. Smoke damage was general throughout the building.

Sprinklers had been installed to protect the building during construction. The system had not been connected to a permanent water supply, but a temporary supply had been provided by connection through a booster pump to a 120,000-gallon process tank in the mill building. It is felt that this temporary arrangement would have permitted the sprinklers to control the fire, but unfortunately the sprinkler contractor had disconnected the water supply in order to add additional equipment to the system, and had left without putting the system back in operation or advising anyone that there was no water.

†Figure includes business interruption loss.

At the time of the fire the concentration tanks in the second story were either in the process of being coated with an asphalt insulation or had just been coated. The fire broke out on the insulation being applied to one of the tanks, when sparks from welding being done overhead dropped on the coating. (The solvent in the coating had a flash point of 100°F.) Fire spread rapidly over the coatings on the congested tanks and jumped to the wood roof deck. Approximately 900 sprinklers fused on the waterless system. Standpipe hoses which employees attempted to place in operation were also useless due to lack of water. Several volunteer fire departments sent pumpers to the scene and by locating them at a lake, firemen were able to get water on the fire and save about two-thirds of the building.

Clubs, Country

Dec. 12, Overland, Mo., Meadowbrook Country Club. $500,000

Destruction of this unsprinklered 18,000 sq. ft. 2-story brick, wood-joisted building probably could have been prevented by the public fire department had the watchman telephoned the alarm as soon as he smelled smoke. Instead, he called the head maintenance man and one of the board members, both of whom told the watchman to see if he could locate anything.

On going to the second story he discovered fire raging in the concealed space above a suspended ceiling and parts of the ceiling were already falling. This was 40 minutes after he had first noticed smoke. The alarm was then telephoned, but because of the delay fire had broken through the heavy tile roof before apparatus arrived.

The private fire hydrant on the club grounds was found to be frozen.

Forest Fires

May 6, Plymouth County, Mass. $1,500,000

100 square miles, 50 buildings. Following a long dry period, fire of undetermined cause broke out and destroyed approximately 100 square miles of ground cover, including low value timber. Fifty summer homes and other buildings were destroyed.

Wide World

A forest fire in Plymouth, Mass. was one of 16 during 1957 which caused in excess of $250,000 property damage. The Plymouth fire burned 100 square miles of ground cover and destroyed 50 buildings. (See report, page 298.)

Omaha World-Herald

During transfer of gasoline from the fuel tank of one truck to another, gasoline spilled and ignited in the second story of the garage at Omaha, Nebraska. (See report, page 300.)

June 1, near Porterville, Calif., Sequoia National Forest. $800,000

400 acres. Fire believed set by lightning during a drouth period smoldered undetected for several days before flaring up and spreading through over 400 acres of brush and heavy timberland.

June 10-Aug. 28, Kateel River, Alaska. $1,761,000

1,161,200 acres. Five fires set by lightning on June 10, June 12, June 18, July 12 and August 28 joined into one big fire that swept 1,161,200 acres and destroyed 400,000,000 board feet of cordwood timber.

June 11, Holikachuk, Alaska. $1,218,000

266,000 acres. Fire set by lightning burned 266,000 acres and destroyed 522,000,000 board feet of millable timber.

June 23, Anvik River, Alaska. $1,005,000

405,000 acres. Fire set by lightning destroyed 400,000,000 board feet of millable timber, watershed valued at $100,000 and wildlife valued at $305,000.

July 1, Shageluke, Alaska. $1,019,000

644,380 acres. Fire set by lightning destroyed 250,000,000 board feet of millable timber and wildlife valued at $644,380.

July 6, Rolling Creek No. 1, Alaska. $572,000

280,000 acres. Fire set by lightning destroyed 15,000,000 board feet of cordwood timber, watershed valued at $270,000 and wildlife valued at $280,000.

Nov. 29, Gale, Calif., Angeles National Forest. $24,309,500

24,800 acres. A camp fire spread out of control and destroyed 24,800 acres of watershed. Cost of suppressing the fire was $550,000 (not included in loss figure).

Garage

June 8, Omaha, Nebr., Watson Bros. Transportation Co., Inc. $518,000; 1 killed

In order to get gasoline for a truck in the garage that had run out of fuel, employees pressurized the 40-gallon fuel tank of another truck with compressed air and extended a hose from the tank to a 5-gallon can. While the transfer was taking place the hose fell out of the 5-gallon can, and gasoline discharged on the floor and ignited. Flowing burning gasoline caused fuel tanks on other vehicles and oil drums to rupture, resulting in a fire that spread rapidly through the undivided second story and through floor openings to the first story of the unsprinklered 3-story brick, wood-joisted building. The 30 employees escaped with difficulty and one who returned for his tools was trapped and killed.

A 7-story building one foot from the truck terminal was saved by wired glass in metal frame windows and by a water curtain formed by fire department hose streams and manually operated open sprinklers.

Gas Compressor Station

Jan. 16, near Liberal, Kans., Panhandle Eastern Pipeline Co. $885,000; 3 killed

Natural gas compressor station. Three men were killed and twelve injured by an explosion at a natural gas pipe line compressor station. A valve failure in the compressor room allowed natural gas at 900 pounds pressure to escape and ignite from an unknown source. The 1-story 68 ft. by 364 ft. corrugated sheet metal building was severely damaged by the explosion. Fire burned for two hours until the gas could be shut off.

Hangar

Jan. 15, McChord Air Force Base, Wash., U. S. Government. $5,192,000

Construction features of two unsprinklered communicating hangars were directly responsible for the almost total destruction of their combined 180,000 sq. ft. area. A fire guard (rounds every half-hour) gave the 5:30 A.M. alarm by telephone, but immediately before the bell rang in the main fire station, a fireman noticed flames coming through the roof of the hangar. Obviously, the fire, which originated in the vicinity of a coffee shop in a wooden mezzanine island structure between the two hangars, had been burning long enough to penetrate and vent itself through the glass skylights in the asphalt protected metal roof covering, 96 feet above the hangar floor.

Wide World

Two communicating hangars at McChord Air Force Base, Wash. were destroyed by fire that originated during the night. Drops of burning asphalt from the asphalt-coated metal roof helped spread the fire rapidly through the buildings.

Air base fire fighters responded quickly but early in the fire they were handicapped by the extent of the fire and a scarcity of personnel (24 men on duty) and fire fighting equipment suitable for building fires. Attempts to extinguish the fire on the mezzanine from inside the smoke-charged hangar using a crash truck turret stream and 2½-inch hose lines were unsuccessful and as portions of the metal roof fell to the floor and oxygen cylinders exploded, fire fighters were required to withdraw. The rapid spread of fire was influenced by the coating of asphaltic material on the roof and end walls of the hangar. Fire fighters observed burning drops of asphaltic mastic falling from the ceiling which ignited all combustible materials on the floor. A four engine C-124 Globemaster, a C-118 and three smaller aircraft in the hangar were extensively damaged. Burning drops of asphalt started the fires in these largely defueled aircraft (only one F-86 had some fuel aboard). Similar ignitions occurred in the tire repair shop, fabric section of the paint shop and in storage areas of Hangar No. 2.

The fire walls at the north, east and south walls of the two adjoining and communicating hangars retained the fire from entering the annexes and shops except at one point on the east wall (near the carpenter shop) where a nonstandard metal door with a wired glass window failed. Mutual aid response from Tacoma, Lakewood, Pierce County, Fort Louis and the Mt. Rainier Ordnance Depot helped immeasurably to save the annexes and shops around the perimeter of the two hangars.

Lumber Yard

***Aug. 3, Rotterdam, N. Y., Palma Lumber Co. $500,000**

This 180 ft. by 170 ft. lumber yard, consisting of a U-shaped group of attached combustible buildings surrounding a canopied lumber storage area, was destroyed by fire that broke out in one of the sheds during a thunderstorm. Lightning was the probable cause. Since the sheds were not sprinklered and no watchman was on duty, discovery at 10:28 P.M. was by a neighbor.

Had the sheds been separated by firewalls and had the lumber in the canopied area been stored in well separated piles it is probable that fire could have been confined to the

*Fire spread to other buildings.

Goertz Studios

An explosion of solvent vapor in the first story cleaning room preceded fire at this dry cleaning plant at Edmonton, Alta. Faulty operation of the exhaust system on a drying tumbler was the probable explanation for the solvent (closed cup flash point 190°F). As flames started up the open rear stairway the more than 70 employees in the second story escaped down an enclosed stairway in the front.

Drennan Photo Service

While employees of this lumber yard at Massapequa, N. Y. were home for lunch fire broke out. Although the cause could not be determined, reports noted that the rear of the yard was not fenced and therefore was accessible to trespassers.

building of origin. Although 350 firemen, well equipped and with a good water supply, fought the fire it could not be controlled for three hours and was not extinguished until 22 hours later.

Office Buildings

March 21, Chicago, Ill., City of Chicago. $500,000

Wide World

City and county offices, including fire alarm headquarters. Despite the presence of more than 100 people in this unsprinklered 13-story fire-resistive building, fire that originated in a second story storeroom containing wooden lockers and other combustible materials burned an estimated 30 minutes before it spread into the adjoining 2-story-high Council Chamber. It was discovered by electricians working near the rostrum. An extensive amount of combustible furnishings and ornate oak panelling attached to 2 in. by 4 in. furring strips provided fuel for an intense fire that spread so rapidly that those in the Council Chamber had to run for their lives. Fire gutted the Chamber and spread into the third story before being extinguished.

Heavy hose streams directed through windows were ineffective due to interfering partitions and it was only after hoses had been advanced up ladders and up inside stairways that the fire was controlled. Most of the occupants used elevators to escape but several were trapped and had to be taken down fire department ladders.

The first floor and basement housed the city's fire, water and electrical department offices. Outstanding salvage work by the Chicago Fire Insurance Patrol, which spread more than 600 waterproof covers, prevented damage by water to records and equipment in offices beneath the fire.

The fire alarm office that handled alarms for more than half the city was located on the fifth floor. Although fire alarm operators were bothered by smoke they remained on the job throughout the fire.

June 20, Lorain, Ohio, U. S. Steel Corp., National Tube Division. $1,200,000

Metallurgical offices, tabulation department, records, roll and tool shop offices; bearing conditioning department. During the night, fire originated in a 2-story wooden office section that had been erected in one end of the 450 ft. by 50 ft., high 1-story brick, wood-joisted building (formerly a roll shop). An electric hot plate left "on" in the ladies' lunch room in the first story of the office section was the probable cause. Fire had spread throughout the office section before discovery by a passerby at 3:48 A.M. Before arrival of firemen a high pressure 4-inch gas pipe suspended beneath the roof ruptured, releasing gas that caused the fire to spread beneath the wood roof of the undivided and unsprinklered building. Business machines valued at more than $1,000,000 were severely damaged.

*Nov. 23, Kansas City, Mo., 804 Grand Building, et al. $500,000; 1 killed

Offices, schools, dental laboratories; printers, mailing houses; parking garage. No one was in the 6,000 sq. ft. 7-story brick, wood-joisted 804 Grand Building at 9:29 P.M. when a violent explosion occurred in the upper part of the building. The roof and top floor were lifted, side walls were blown out and as the roof and top floor fell back into the building all of the floors progressively collapsed. Intense fire broke out in the rubble.

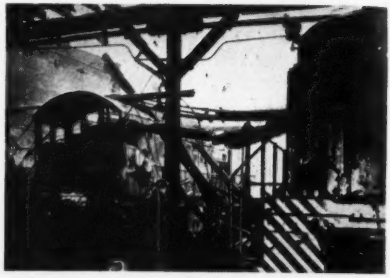
One of the walls that was blown out fell on the 5,400 sq. ft. 3-story brick, wood-joisted Sterling Building that was across a

*Fire spread to other buildings.

narrow light well from the 804 Grand Building. Part of this building also collapsed and fire broke out in the debris. One of the two men working in a printing plant on the third floor of the Sterling Building was trapped and killed.

On the other side of the 804 Grand Building, a wall fell on a 1-story and basement reinforced concrete parking garage. The 4-inch-thick pan type roof was crushed and several cars were destroyed.

The cause of the explosion, which apparently originated in the fifth story of the 804 Grand Building, has not been determined. The fifth story was occupied by a teachers' agency and by a church office.



Wide World

Roundhouses

Jan. 5, Selkirk, N. Y., New York Central Railroad. $500,000

Diesel locomotive roundhouse. One of the four 8-track sections of the semicircular brick, wood-joisted roundhouse was destroyed by fire that originated in wooden roof timbers. A spark from a diesel locomotive under test in the building was the probable cause. On discovering the fire railroad employees were able to remove all except five of the 16 engines in the section before the roof fire made it impossible to reenter the building. In addition to the five engines that could not be removed and were destroyed, one other was badly damaged and two suffered slight damage before removal. Unpierced fire walls kept the fire from adjoining sections of the 4-section building.

Brooks Crummett

A violent explosion occurred in an office building in Kansas City, Mo. during the night. No one was in the building but one of two men in an adjoining building was killed.

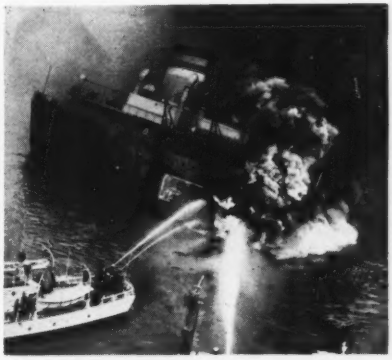
Nov. 24, Forest View, Ill., Gulf, Mobile and Ohio Railroad, et al. $500,000

Roundhouse; plywood storage. Poor public water supplies and delayed fire department notification were two important reasons why his men were unable to save this large 1-story brick, wood-joisted building, according to the local fire chief. The fire originated in an unoccupied part of the building and consequently was not discovered at once. When finally discovered by railroad employees they removed six locomotives to safety and did not give the alarm, delaying fire department notification until police in a cruiser passed by, saw the fire and radioed the alarm.

Despite the delay in alarm, firemen believe they still could have saved two-thirds of the building if there had been a good water supply nearby. With the nearest hydrant three blocks away fire fighting was ineffective and the fire spread unchecked through the oil-soaked and undivided building. High piles of plywood stored in one section of the building by a building supplies company added to the intensity of the fire.

Ships

March 7, near New Castle, Del., U. S. Government, et al. $3,500,000; 10 killed



United Press

10,388 ton tanker "USNS Mission San Francisco"; 3,149 ton freighter "Elna II". While proceeding in opposite directions

Calvin D. Campbell

In Boston, Mass., fire broke out beneath the deck of a 2500-ft.-long coal unloading pier. In the absence of sprinklers and fire walls beneath the pier deck, fire spread rapidly through the substructure.

through a bend in the Delaware River the two empty vessels collided. Severe explosions occurred aboard the tanker (it had discharged a cargo of aircraft turbine fuel and JP-4 jet engine fuel the previous day) and fire broke out on both vessels. Ten of the tanker's crew were killed and the ship eventually sank. The freighter did not sink but was a total loss.

Sept. 17, Tacoma, Wash., "Pacific Queen" $600,000; 1 killed

Refrigerated fishing vessel. One man aboard the 800 ton vessel (converted mine sweeper) was killed and another was injured when an explosion ripped the vessel apart while moored to a pier. The ensuing fire was fed by 3,200 gallons of gasoline released from two storage tanks in the stern.

Although the cause of the explosion has not been determined definitely, the fact that a cutting torch had been used in the engine room 12 hours prior to the explosion has suggested to fire department investigators that a smoldering fire started by sparks from the cutting operations may have preceded the explosion.

Nov. 24, near Woodsfield, Ohio, Ashland Oil and Refining Co., et al. $625,000

Six river barges. While six barges loaded with petroleum products (two carried gasoline, two diesel fuel, one crude oil, one asphalt) were in a lock in the Ohio River, fire broke out on the water and enveloped the barges. Apparently gasoline had leaked from one of the barges during the 17 minutes the barges had been in the locks. There were no explosions. The burning barges were moved out of the lock after which fire departments from within a 40-mile radius fought 12 hours to control the blaze. Foam was given the principal credit for checking the fire.

Wide World

Congested combustible construction in combination with high winds resulted in the destruction or damage of 22 dwellings and three schools at Rankin, Pa. Two small boys started the fire in a vacant dwelling.

Miscellaneous Other Fires with Losses from $250,000 – $500,000

Armory

Feb. 3, Nashua, N. H., National Guard Armory $300,000

Auditorium

Nov. 3, Roanoke, Va., American Legion Auditorium $250,000

Bowling Alley

*Oct. 3, Auburn, Calif., Opera Bowl, et al. $250,000

Building Being Demolished

*March 14, New York (Manhattan), N. Y., Bonded Wrecking and Lumber Corp., et al. $250,000

Building Under Construction

Oct. 31, Philadelphia, Pa., Penn Fruit Co., Inc. $300,000

Courthouse

Feb. 22, Salyersville, Ky., Magoffin County Courthouse $250,000

Forest Fires

June 7, Sleetmute, Alaska $250,000
June 8, Halfway Roadhouse, Alaska $283,000
June 23, Bonasila, Alaska $316,000
June 23, Titna, Alaska $282,000
July 5, Beetles W-40, Alaska $295,000
July 12, – Aug. 1, Rocket, Alaska $487,500 (Four fires started by military rockets on July 12, July 14, July 16 and August 1 merged into one fire)
Aug. 21, near Montreal, Que, Mt. St. Hilaire $250,000
Sept. 9, Morris, Calif., Angeles National Forest $360,000

Garages

Jan. 16, Midland, Mich., Producers Transport, Inc. $300,000
Jan. 24, Bethel, Conn., B. J. Dolan, et al. $475,000
Feb. 1, Lewes, Del., Gallagher Motors $250,000
June 13, Vancouver, B. C., Pacific G. M. C. Co., Ltd. $325,000
Dec. 18, Tillsonburg, Ont., Stedelbauer's Garage, et al. $250,000

Gas Well

July 27, Terrell County, Texas Magnolia Petroleum Co., et al. $450,000

Greenhouse

Sept. 30, Toledo, Ohio, Heinl Greenhouses $320,000

Hangar

Nov. 29, Neebing Twp., Ont., Thunder Bay Flying Club, et al. $428,000

*Fire spread to other buildings.

Laundries and Dry Cleaning Plants

July 20, Nogales, Ariz., Kolmart Investment Co., et al. $300,000
Dec. 23, Edmonton, Alta., Trudeaus Cleaners and Dyers, Ltd. $318,000

Lumber Yards

*Jan. 28, Massapequa, N. Y., White's Lumber Co. $400,000
*May 7, Detroit, Mich., Grace Harbor Lumber Co. $310,000
*June 22, Lima, Ohio, Tuttle Lumber Co. $366,500
Aug. 9, Waterbury, Conn., J. E. Smith and Co., Inc., et al. $432,000
*Sept. 5, Everett, Mass., Central Building Wrecking Co., et al. $454,500
*Nov. 30, Toronto, Ont., G. Rathbone Lumber Co., Ltd. $259,000

Motion Picture Studio

Sept. 25, Los Angeles County, Calif., Universal Pictures Co., Inc. $395,500

Office Buildings and Banks

Jan. 9, San Francisco, Calif., Hansford Building $412,000
*Feb. 13, Pittsburgh, Pa., Burke Building, et al. $250,000
Sept. 9, Coeur d'Alene, Idaho, Powell Building $457,500
Oct. 3, Toronto, Ont., Royal Bank Bldg. $250,000
Oct. 22, Farmville, Va., Insurance Building $250,000

Piers

April 23, New York (Coney Island), N. Y., Steeplechase Pier $250,000
*June 29, Jersey City, N. J., Pennsylvania Railroad $276,000
July 26, Boston, Mass., Pocahontas Coal Co. $465,000

Ships and Barges

Dec. 10, near Leeville, La., Norton Drilling Co. $400,000

Television Studio

Nov. 1, Little Rock, Ark., Little Rock Telecasters, Inc. $250,000

Vacant Buildings

Feb. 16, Buffalo, N. Y., Benderson Development Co. $250,000
*June 2, Buffalo, N. Y., Benderson Development Co. $300,000
*Dec. 23, Rankin, Pa., Owner Unknown $308,000 (Owner of vacant dwelling, where fire was set by two children, unknown. Fire destroyed or damaged 22 occupied dwellings scheduled for demolition, and three schools.)

An Adiabatic Spontaneous Heating Tester

By Joseph P. Little, Research Section
Factory Mutual Laboratories

Due to inherent apparatus inadequacies, test results achieved with the Mackey tester* are frequently contrary to the behavior of the tested material in practice. With some materials this disparity between test results showing little or no indication of spontaneous heating, and actual storage conditions where spontaneous heating to ignition has been detected, led several investigators to modify the apparatus or technique or both. Modifications were concerned with the conservation of developed heat to further accelerate any reaction that might occur. Thompson[1] found that test results were profoundly influenced by this factor and accordingly developed a method whereby the sample size was increased and the bath temperature manually maintained within 2°C of the sample at all times. Another investigator,[2] recognizing the need for heat conservation, improved results by regulating the packing density.

In addition to heat losses from the sample material prohibiting spontaneous heating reactions in the Mackey tester, the depletion of available oxygen by stagnation of the atmosphere surrounding the sample is also a factor in the sometimes erratic results achieved. For, in addition to temperature, reaction rate is dependent upon concentration of reactants; in an exothermic oxidation reaction, diminution of the oxygen available results in a proportional decrease in reaction velocity and a decrease in heat development per unit time.

In consideration of these factors of (1) developed heat conservation and (2) optimum reactant concentration (optimum from the standpoint of duplication of actual conditions) and other related factors not directly applicable to this discussion, an adiabatic spontaneous heating tester has been developed in which inhibitory action from these factors is greatly minimized and the potential fire hazard of oxidizable oils and other materials is more accurately indicated. Adiabatic testers of somewhat similar operating principles,[3,4] but of rather complex design have been developed by other investigators of spontaneous heating. However, the particular tester described herein is suitable for testing a wide range of materials, is comparatively inexpensive and can closely duplicate the most severe conditions to which the material may be exposed in practice without introducing any unnatural conditions.

*This tester is essentially a water jacketed cylinder, 4 inches in diameter, closed at the top by a cover having a center hole to accommodate a thermometer. (See Figure 1.) Two draft tubes (6 inches x .5 inches) are attached to the cover. In operation one draft tube is inside the test chamber and the other projects above it. The water in the jacket is brought to boiling and the sample is placed in the test chamber. The sample is prepared by absorbing 14 grams of the material to be tested on 7 grams of absorbent cotton and placing this preparation in a wire gauze cylinder about 1¾ inches in diameter and 6 inches long. After the sample is introduced the thermometer is inserted through the top into the sample and readings of the temperatures taken at regular intervals.

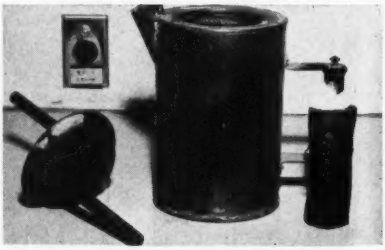


Figure 1. The Mackey Tester described for comparison purposes in the footnote.

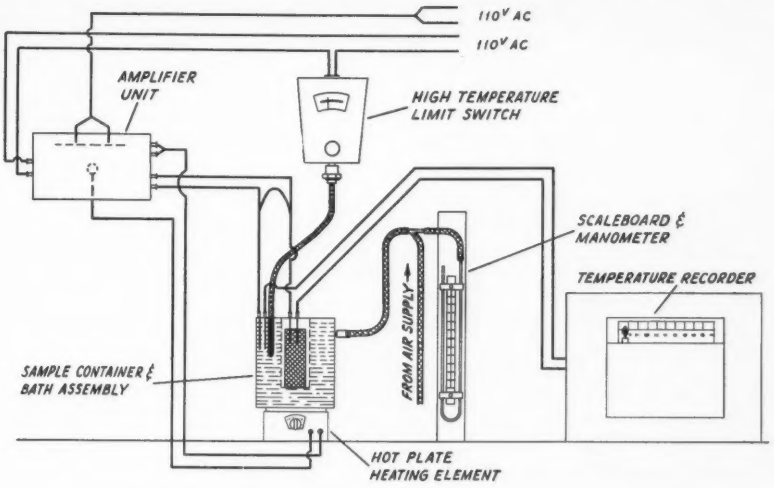


Figure 2. Schematic layout of Factory Mutual Laboratories Adiabatic Spontaneous Heating Tester

Description of Apparatus

The complete apparatus, of which a schematic layout is shown in Figure 2, consists of a test chamber and auxiliary equipment including heater (with bi-metallic temperature control), amplifier, phase detector circuit (Figure 3), high temperature limit switch, multi-point recorder, thermocouples and air supply with manometer.

The construction of the test chamber is depicted in Figure 4. Heat transfer medium is a heavy cylinder oil having a flash point of 310°C. Air, preheated in the copper coils, passes into the test chamber at the rate of 150 cc/min. Oil is circulated by convection currents; at temperatures of 95°C and 150°C the temperature gradient along the bath side of the sample holder does not exceed 1°C which is sufficiently small to make the addition of mechanical stirring an optional feature.

Recovery rate of the heater was found to be 2°C a minute which for most investigations appears quite adequate.

Since bath temperature may be controlled by sample temperature, initial bath temperature may vary between room temperature and 260°C depending on the material being investigated.

Initial bath temperatures are set and maintained by the thermostatic control on the Temco hot plate. Temperature variation is held within 1.1°C between 95°C and maximum. Bath temperature is maintained by this control as long as sample temperature does not rise more than 2°C above the bath. When sample temperature does exceed this differential, the heater control is bypassed and the heater is controlled by the differential thermocouple arrangement. This action is reversible in that the bath temperature would be prevented from falling below the preselected level by the bi-metallic control should spontaneous heating cease during the test.

The high temperature limit switch is set to shut off power supplies to the heater and amplifier when the bath temperature exceeds 290°C.

Key

- **T** Type R-100 Thordarson transformer, 2-1 stepdown
- **T'** Type R-101 Thordarson transformer, 1.6-1 stepdown
- **S** 70 mil metallic rectifier
- **C** 2 microfarad condenser, 150 volt D.C.
- **R** Variable resistance (10,000 ohm max.)
- **1-R** DC relay, 10,000 ohm, Potter and Bromfield, LB5
- **2-R** 110 volt A.C., 60 relay
- **B** Bimetallic heater control (part of hot plate assembly)
- **H** Model 1900 Tempco hot plate
- **L** High temperature limit switch

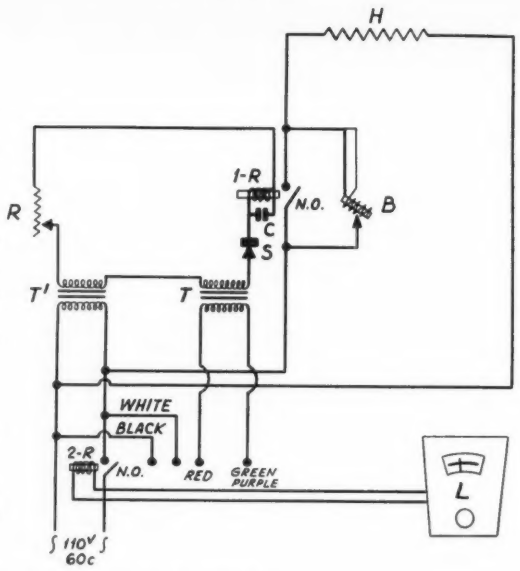


Figure 3. Phase detector circuit of FM Tester.

Operation of Tester

Differential and recording thermocouples are inserted in the sample and in the bath. Temperature of the bath is brought to the desired temperature before the sample is inserted into its chamber and the air supply regulated. By means of the recording thermocouples, a constant time-temperature record of bath and sample temperatures is maintained throughout the test.

The differential thermocouple acts to detect any spontaneous heating of the sample and to preserve this heat by operating the heater whenever the sample temperatures exceed the bath temperature by 2°C. The heater automatically drops out when the differential becomes less than 2°C. Control is accomplished by connecting two thermocouples in a differential series and feeding their combined signal into a Brown Electronik Amplifier, Model No. 356358-1. The phase of the amplified a-c signal, as determined by the input polarity, can then be detected by the means of the circuit arrangement and made to operate the relay controlling the heater.

The automatic control mechanism operates as follows:

The secondaries of two transformers are connected in series through a half-wave rectifier and the relay coil, across which a capacitor is connected to prevent contact chattering. The primary of one transformer is connected to the power line to furnish a reference voltage of fixed magnitude and phase, the primary of the other is connected to the amplifier output. In this circuit, when the amplifier voltage is in phase with the reference voltage it adds to it so the rectified voltage across the relay coil increases. Conversely, when the amplifier voltage is 180° out of phase the relay voltage decreases. The differential thermocouples are connected to the amplifier input so that an increase in sample temperature over bath temperature results in an increase of voltage across the relay coil.

Operating characteristics of the relay used determine the magnitude of the fixed refer-

ence voltage and the ratio of the amplifier-output transformer. The reference voltage must be less than the drop-out voltage of the relay and the sum of the amplifier voltage and the reference voltage must exceed the pull-in voltage of the relay. With a bath temperature higher than the sample temperature and increasing, the relay voltage will decrease to zero and then increase until the amplifier saturates. This maximum is equal to the amplifier saturation voltage minus the reference voltage and must be less than the relay pull-in voltage.

To prevent pull-in of the relay, when the bath temperature is extremely high in comparison with the sample temperature, the sensitivity of the instrument is adjusted by means of the variable resistance and the amplifier sensitivity control so that saturation is achieved at a point well below relay pull-in voltage. The particular relay used, pulls in at 42 volts and drops out at 24 volts. Maximum voltage achieved at the relay, that is, saturation of the amplifier by the negative or bath thermocouple, is 35 volts.

Although the instrument has sufficient sensitivity to operate when the sample temperature exceeds the bath by .6°C, danger of faulty operation by pickup of transient strays severely limits operation at this sensitivity. By maintaining a maximum allowable differential 2°C over bath, reliability of smooth operation is enhanced, danger of "overshooting" and heating artificially removed.

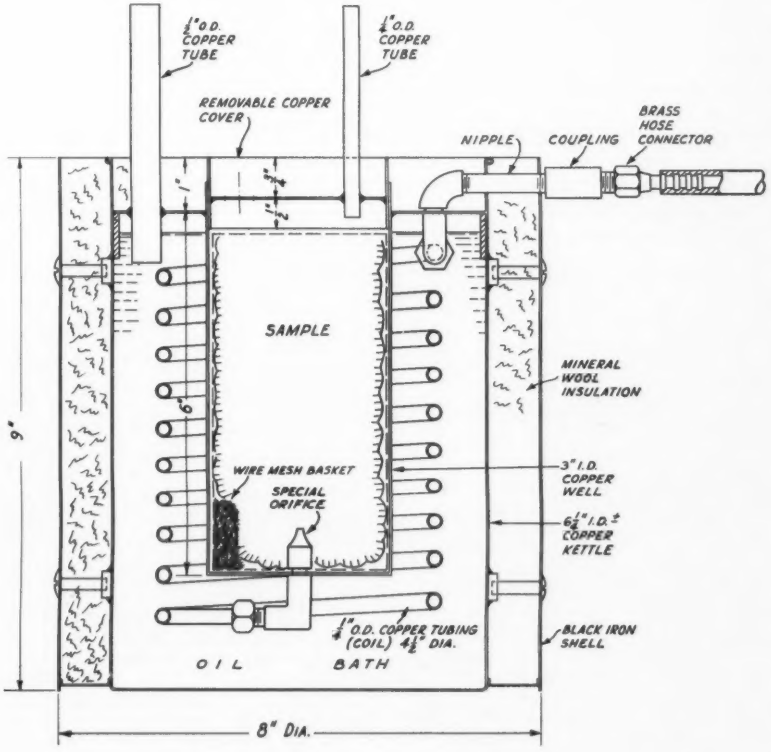
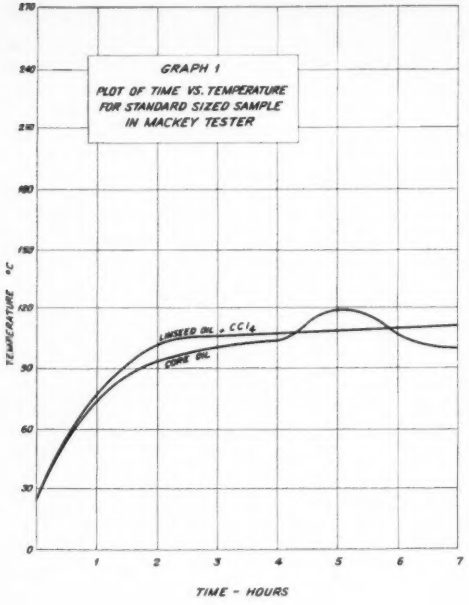


Figure 4. Construction of the Factory Mutual Adiabatic Spontaneous Heating Tester showing sample container and bath assembly.


GRAPH 1
PLOT OF TIME VS. TEMPERATURE FOR STANDARD SIZED SAMPLE IN MACKEY TESTER
TEMPERATURE °C
TIME - HOURS
LINSEED OIL + CCl4
CORE OIL

to be tested and uniformly packed into a wire gauze cylinder having a length of 6 inches and a diameter of 2½ inches. The bath temperature of the Mackey was maintained at 100°C, the bath of the adiabatic tester was set to maintain a minimum of 100°C.

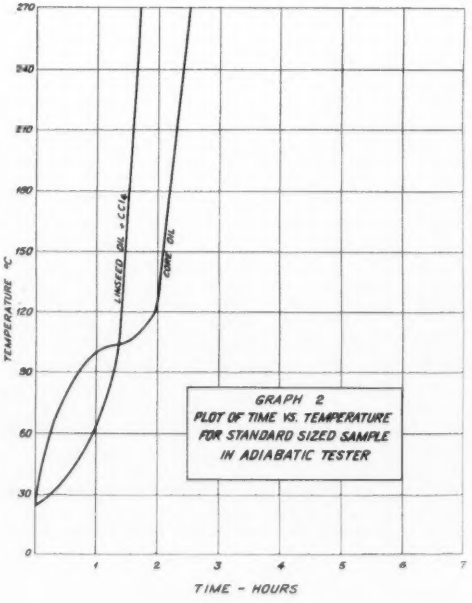
Graphs 1 and 2 are facsimiles of the time-temperature records for the samples tested.

The core oil, a slow heater, loses most of its developed heat in the Mackey tester and reaches its maximum temperature of 118°C after five hours. By conserving the heat developed, the reaction is accelerated to ignition in the adiabatic tester in only 2½ hours. This sample is representative of many prepared mixtures containing an oxidizable oil

Comparison Tests with Mackey Tester

For comparison of performance of the Mackey tester with this FM adiabatic tester, samples were specifically chosen to point up the inadequacies previously mentioned. Identical samples were prepared from commercial grade boiled linseed oil mixed with 20 per cent carbon tetrachloride by volume, and commercial core oil* as received.

Samples were prepared in the usual manner: 30 grams of clean cotton waste were saturated with 30 grams of the oil


GRAPH 2
PLOT OF TIME VS. TEMPERATURE FOR STANDARD SIZED SAMPLE IN ADIABATIC TESTER
TEMPERATURE °C
TIME - HOURS
LINSEED OIL + CCl4
CORE OIL

*Core oil is used in foundries for binding core sand. Deposits are frequently found in ovens, ducts, etc. at these locations. It does not have a specific chemical formula; it is generally a compound of vegetable oil and bleached neutral oil.

in limited quantity. When provision for heat conservation is not available, oxidation proceeds at such a reduced rate that elevation of temperatures above bath is manifested to only a slight degree before oxidation is complete.

The purpose of using linseed oil, a known heater, and carbon tetrachloride was, of course, to point out the lack of air circulation in the sample chamber of the Mackey tester. Results for this test indicate that carbon tetrachloride vapors inert the atmosphere of the sample to the degree that oxidation takes place at such a slow rate that sample temperature exceeds bath temperature by only 13°C after 7 hours. The lack of convection air currents decreases the rate of any slow reaction after a lengthy induction. The use of a tester which automatically maintains a small temperature gradient between a sample and its surroundings and also maintains a free supply of air without robbing the sample area of any heat will provide the most severe atmosphere for testing materials suspected of having spontaneous heating tendencies.

Interpretation of tests is especially interesting when one considers that with the original Mackey method oils that do not exceed bath (100°C) in one hour or 200°C in two hours are considered safe as far as tendency for spontaneous heating is concerned.

Although not fully investigated at this time, this new apparatus, in which an environmental temperature between room temperature and 260°C can be steadily maintained or automatically altered to reduce sample heat losses, appears ideally suited for testing grains or other organic material in which microbial actions both aerobic and anaerobic, are factors.

Microbial action, producing spontaneous heating, is generally considered as occurring in two separate steps each having a specific temperature range which cannot be exceeded without destruction of the organism responsible for the action.[5, 6] This tester will allow the natural processes to occur without curtailing activity through production of an immediate sterilizing

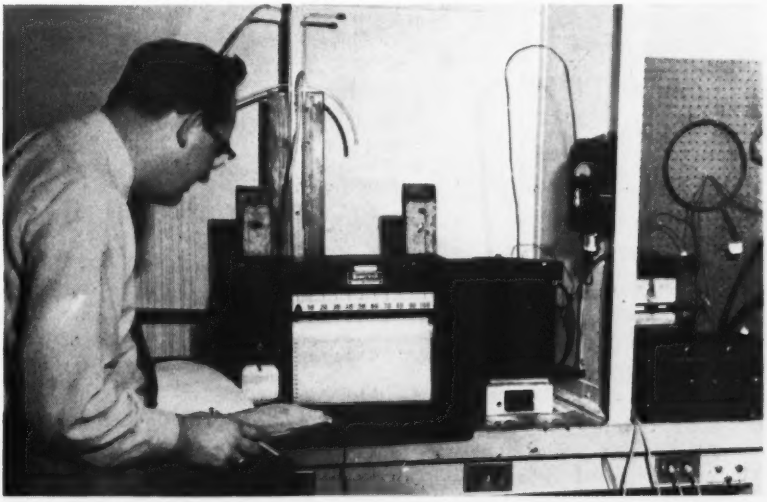


Figure 5. Mr. Little checking the recorder during a test with the FM Adiabatic Spontaneous Heating Tester (center). The instrument on the far right is the amplifier.

heat. Supplying temperature environment most conducive to microbial habitation should result in the maximum formation of the unstable materials[7] which are thought to be responsible for chemical self-heating after microbial action has ceased.

Acknowledgment

The author wishes to express his appreciation to E. W. Cousins, Chief Research Engineer, Factory Mutual Laboratories, who developed the phase detector circuit and to the Factory Mutual Engineering Division for permission to publish this paper.

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Fire Record of Cities, 1957

As Reported by Municipal Authorities

The following tables summarize fire department reports for 1957 in 644 of the 699 cities with population over 20,000 in the United States and Canada.

These statistics have been collected and published in the April QUARTERLIES since 1939. These tables should not be used as a basis for comparing cities, as a comparison based on these statistics may be misleading if used without a full understanding of the many factors which should be taken into consideration. The principal discrepancy results from the wide variation among fire officials as to what constitutes a fire loss. Certain reports include only insured losses, others only uninsured. Whether or not property is insured has no bearing on the actual value of property destroyed. The chance effect of a single large loss fire, differences in degree of industrialization, in topography, climate and age of cities are some of the factors that influence the fire record. In other words, fire losses reflect the composite results of many factors in addition to fire department efficiency and therefore the practice of making comparisons among different cities based on these data is to be discouraged.

In recent years the 1950 census figures have been used in compiling the statistics for this annual study. In order to increase the accuracy of current figures the population estimates for 1957 were used. For comparison purposes the 1956 figures also have been adjusted.

Fire departments of 550 United States cities and 47 Canadian cities of over 20,000 population have reported their estimates of fire loss, fire alarms, building fires, and false alarms for 1957 to the NFPA Department of Fire Record.

A total of 575 United States cities reported a fire loss for the year 1957 of $246,750,000. Forty-nine Canadian cities reported a loss of $33,939,000.

The average loss per person in the 575 U. S. cities reporting losses was $3.84, 1.8 per cent less than the $3.91 average loss in 1956. The per capita loss in the 49 Canadian cities reporting losses was $5.44, a 6.7 per cent increase from 1956.

The average loss per building fire in 521 U. S. cities for 1957 was $1,085, compared with $1,075 in 1956, and $931 in 1955. The average building fire loss in 41 Canadian cities was $1,625 in 1957, $1,210 in 1956, $895 in 1955.

The total number of building fires reported by 585 U. S. cities was 257,417, an average of 3.6 fires per 1,000 population, the same number of building fires per 1,000 population as in 1956. Fifty Canadian cities reported 22,084 building fires in 1957. The number per 1,000 population was 3.5 in 1957 as compared with 3.9 in 1956.

Motor vehicle fires reported by 572 U. S. cities totaled 63,816, an average of 0.94 fires per 1,000 population. Fifty Canadian cities reported 3,950 motor vehicle fires, or 0.63 per 1,000.

Fire departments in 590 U. S. cities of more than 20,000 population answered 886,050 alarms in 1957. The number of alarms in 49 Canadian cities was 71,767.

In the United States, 578 cities of over 20,000 reported 78,915 false alarms in 1957. This was 8.9 per cent of the total calls. It will be noted that these are "malicious false alarms," not cases where smoke or steam, etc., was honestly mistaken for fire. The 9,998 false alarms reported by 49 Canadian cities were 13.9 per cent of their total calls.

Fire departments have been very cooperative in furnishing fire loss figures. Most of the 55 nonreporting cities did not record their fire experience. A number of loss figures are indicated in the Tables as preliminary estimates.

1957 FIRE LOSSES, CITIES OF 20,000 POPULATION AND OVER

As Reported by Municipal Authorities

	Total Loss in 1,000's	No. Alarms	Bldg. Fires	False Alarms	Bldg. Fires/ 1,000 Pop.
ALABAMA					
Anniston	118	542	198	26	6.4
Bessemer	...	...	...	...	..
Birmingham	922	4,576	1,661	533	4.6g
Dothan City	115c	396	184	8	8.5
Florence	...	367	138	22	6.0
Gadsden	313	745	218	85	3.9
Mobile	562c	1,532	189	104	1.1g
Montgomery	310d	1,199	481	128	2.5
Phenix City	...	...	...	...	..
Selma	60	190	108	12	3.9g
Tuscaloosa	394	419	209	38	4.5
ARIZONA					
Phoenix	453ac	2,272	595	146	5.7
Tucson	294	1,372	180	87	1.8g
ARKANSAS					
El Dorado	88	287	112	32	4.5g
Fort Smith	339	799	157	62	2.6g
Hot Springs	129	288	138	20	4.7
Little Rock	1,575	1,774	606	248	5.6g
N. Little Rock	...	...	...	...	..
Pine Bluff	150d	516	245	17	6.6
CALIFORNIA					
Alameda	139	731	129	87	1.8g
Alhambra	30	410	61	96	1.2
Arcadia	31	436	82	11	2.2g
Bakersfield	358	1,027	199	108	4.2g
Berkeley	163	2,078	471	109	4.2
Beverly Hills	297e	475	125	40	4.0g
Burbank	423	1,151	324	49	3.5g
Compton	78	703	168	19	3.5
Eureka	103	334	121	70	4.1g
Fresno	450	1,009	392	217	3.2g
Glendale	1,081	1,100	341	113	9.6
Huntingt'n Pk.	155c	272	...	20	..
Inglewood	145c	573	160	36	3.5
Long Beach	768c	1,892	824	138	3.4
Los Angeles	...	33,409	11,044	3,977	4.7g
Los Angeles Cty	5,879c	...	2,808	...	1.3
Lynwood	83c	388	73	12	2.4g
Menlo Pk. F.D.	228	891	144	35	2.3g
Monrovia	41	436	86	3	3.4g
Montebello	49	404	77	17	2.6g
Monterey Park	21	333	57	4	1.7g
National City	37	238	45	3	1.4g
Oakland	1,762	6,518	1,656	696	3.5g
Ontario	62c	655	126	15	2.9g
Oxnard	74c	176	60	4	2.8
Palo Alto	315	616	168	44	3.7g
Pasadena[1]	256	1,051	380	130	3.3g
Pomona	125a	796	218	21	3.6g
Redondo Beach	55	406	146	1	3.5g
Redwood City	139	684	75	68	2.9
Richmond	117c	961	223	43	2.3
Riverside	156	786	178	24	2.3g
Sacramento	1,200ac	2,613	670	292	4.1g
San Bernardino	189	1,021	268	99	3.1g
San Diego	852ac	4,070	1,414	241	2.8g
San Francisco	...	11,616	3,176	2,034	4.0g
San Gabriel	28	393	59	5	2.6g
San Jose	231c	1,847	227	205	1.6g
San Leandro	122	608	96	13	1.5g
San Mateo	164	828	317	30	4.7g
Santa Ana	122c	1,040	191	117	2.5g
Santa Barbara	333c	694	182	38	3.3g
Santa Cruz	...	...	...	...	..
Santa Monica	277	1,520	300	120	3.7g
South Gate	133c	682	182	22	3.4g
Stockton	512c	1,675	314	103	3.7g
Torrance	41	776	154	17	1.6g
Vallejo	61	810	152	113	6.5
Whittier	26	307	86	49	2.5g
COLORADO					
Colorado Sp.	...	...	...	...	..
Denver	988	4,877	1,711	519	3.3g
Greeley	52c	192	87	12	3.5g
Pueblo	89	603	266	51	2.7g
CONNECTICUT					
Bridgeport	1,595e	2,368	535	95	3.4
Bristol	244c	687	129	45	3.2g
Danbury	88	580	211	30	9.4
East Hartford	871c	523	105	24	3.6
Fairfield	186	712	90	6	2.0g
Greenwich	405	1,279	166	5	4.1
Hamden[2]	62	760	26	27	0.6g
Hartford	550	2,802	522	295	2.8g
Manchester	5	140	16	2	0.3
Meriden	862	702	202	49	4.2g
Middletown	...	...	...	...	..
Milford	423	801	77	54	1.9g
New Britain	338c	1,178	244	75	3.3
New Haven	843	3,070	786	29	4.8
New London	442ac	552	119	34	3.9g
Norwalk	283	759	214	41	3.3g
Norwich	55	435	108	16	4.7
Stamford	415	654	106	45	1.4
Stratford	145c	583	88	8	3.7
Torrington	62	353	40	20	1.3g
Waterbury	765	1,988	398	121	3.8
West Hartford	541a	650	64	9	1.1g
W. Haven Twp	129	655	24	24	0.6g
DELAWARE					
Wilmington	641	1,408	508	73	4.5g

a. Estimated. c. Building and contents only. d. Insured loss only. e. Subject to change.
g. Based on 1957 population estimate.
1. Fiscal year ended June 30, 1956. 2. Fiscal year ended September 30, 1956.

	Total Loss in 1,000's	No. Alarms	Bldg. Fires	False Alarms	Bldg. Fires/ 1,000 Pop.
DISTRICT OF COLUMBIA					
Washington	2,526	10,002	2,249	1,058	2.6g
FLORIDA					
Daytona Beach	114e	392	91	16	3.1
Ft. Lauderdale	82c	550	148	40	1.8g
Gainesville	40	290	117	24	3.7g
Jacksonville	673a	2,950	702	283	3.2g
Key West	241	201	42	10	0.8g
Lakeland	93	389	142	25	3.3g
Miami	832	3,044	748	116	2.9g
Miami Beach	389c	758	274	45	5.4g
Orlando	128	712	56	38	6.4g
Panama City	...	...	...	...	..
Pensacola	76	322	136	1	3.1
St. Petersburg	156ae	1,472	275	14	1.7g
Tallahassee	108c	721	134	18	3.2g
Tampa	614ae	3,310	779	251	6.3
W. Palm Beach	94	411	56	26	0.9g
GEORGIA					
Albany	51	668	377	51	8.3g
Athens	37	380	150	10	7.5
Atlanta	2,151	5,573	1,781	441	3.5g
Augusta	315	831	390	89	3.9g
Columbus	885c	738	368	63	4.1g
Decatur	...	...	...	...	..
East Point	101	367	126	32	3.1g
La Grange	55	276	82	20	3.3g
Macon	128	603	268	95	3.2g
Marietta	16	333	126	46	3.1g
Rome	159c	350	158	30	3.9g
Savannah	175c	1,480	852	277	6.4g
Valdosta	177	219	177	4	5.2g
IDAHO					
Boise	101c	598	109	35	3.2
Pocatello	147c	362	105	24	3.4g
ILLINOIS					
Alton	104	464	208	6	6.5
Aurora	126	852	181	5	3.2g
Belleville	489	501	139	5	3.5g
Berwyn	98	770	134	7	2.4g
Bloomington	...	...	...	...	..
Champaign	55	363	136	22	3.0g
Chicago	13,350	41,038	20,435	3,126	5.7
Chicago Hts	460	335	169	35	5.8g
Cicero	3,724c	1,869	159	62	2.3g
Danville	87	512	97	9	2.3g
Decatur	281	751	384	27	5.1g
East St. Louis	333	1,268	455	92	5.1g
Elgin	70c	561	63	20	1.3g
Elmhurst	8	223	58	14	1.7g
Evanston	161	1,176	329	...	4.5
Freeport	815	456	110	6	4.9
Galesburg	204	351	61	11	1.9
Granite City	135	428	...	...	..
Harvey	58	472	79	25	3.3g
Jacksonville	52	260	80	8	3.3g
Joliet	153	1,439	138	73	2.2g
Kankakee	258	915	311	12	10.4g
Maywood	327	319	93	23	3.1g
Moline	94	884	180	61	4.8
Oak Park	133	1,612	210	18	3.3
Ottawa	126	271	45	0	2.5
Pekin	238	235	117	7	4.6g
Peoria	361	1,535	414	153	3.5g
Quincy	191	442	115	17	2.6g
Rockford	152	1,220	521	35	5.6
Rock Island	99	645	59	21	1.2g
Springfield	685	1,505	860	26	10.6
Urbana	55	209	79	11	3.0g
Waukegan	206	1,130	243	8	4.9g
INDIANA					
Anderson	38c	921	383	73	7.0g
Bloomington	54	724	231	17	8.0g
East Chicago	401	1,781	283	86	4.8g
Elkhart	93	1,671	199	36	5.1g
Evansville	360	1,703	726	180	5.3g
Fort Wayne	415	1,859	871	167	6.6
Gary	899	2,792	491	429	2.9g
Hammond	102c	1,552	342	157	3.2g
Indianapolis	1,556c	6,728	2,348	261	5.0g
Kokomo	817c	592	210	44	5.4
Lafayette	24c	564	73	30	1.9g
Logansport	138	461	154	55	7.4
Marion	203	631	315	66	9.0g
Michigan City	112	560	244	52	7.3g
Mishawaka	60	428	115	56	3.4g
Muncie	...	...	...	...	..
New Albany	316	402	...	41	..
Richmond	57	550	304	38	6.3g
South Bend	395	1,701	429	258	3.3g
Terre Haute	183c	1,253	475	76	7.4
IOWA					
Ames	180	171	105	10	4.5
Burlington	238	542	85	0	2.6g
Cedar Rapids	103	866	336	34	4.0g
Clinton	...	...	...	...	..
Council Bluffs	221	463	170	31	3.4g
Davenport	71	1,129	156	90	1.8g
Des Moines	1,247	2,322	603	108	2.9g
Dubuque	70	742	210	24	4.2
Fort Dodge	172	269	55	20	2.0g
Iowa City	54	163	76	...	2.8g
Marshalltown	41c	192	109	5	4.9g
Mason City	54	328	72	5	2.6g
Ottumwa	...	689	162	2	4.8
Sioux City	638e	996	412	48	4.9
Waterloo	232	1,100	344	62	4.6g
KANSAS					
Hutchinson	49e	607	99	5	2.6g
Kansas City	854	1,553	469	35	3.6

a. Estimated. c. Buildings and contents only. e. Subject to change.
g. Based on 1957 population estimate.

	Total Loss in 1,000's	No. Alarms	Bldg. Fires	False Alarms	Bldg. Fires/ 1,000 Pop.
KANSAS (Continued)					
Lawrence	25	246	128	4	5.5
Leavenworth	56	349	123	10	6.0
Pittsburg	179	512	47	1	1.9
Salina	49	785	199	8	7.6
Topeka	358a	1,150	242	164	3.1
Wichita	667	2,850	619	63	2.5g
KENTUCKY					
Ashland	...	...	...	...	..
Covington	18	792	304	64	4.7
Lexington	76c	2427	463	111	8.5
Louisville	...	4,009	1,779	387	4.2g
Newport	94c	287	187	33	5.8g
Owensboro	71	643	241	29	5.6g
Paducah	1,009	817	253	39	6.8g
LOUISIANA					
Alexandria	267c	370	73	64	2.1
Baton Rouge	390	1,381	402	208	2.6g
Lafayette	217	272	123	58	3.7
Lake Charles	105	691	186	66	2.8g
Monroe	167b	795	204	93	3.4g
New Orleans	1,631	5,677	1,272	448	2.2
Shreveport	506	1,377	476	105	3.8
MAINE					
Auburn	122a	635	177	5	7.7
Augusta	41c	366	38	16	1.7g
Bangor	106c	635	304	48	9.7
Biddeford	28	452	139	5	7.0g
Lewiston	159	805	204	15	5.0
Portland	124	2,017	137	117	1.6g
South Portland	22	646	142	60	6.5
MARYLAND					
Baltimore	4,683	14,549	6,342	1,491	6.5g
Cumberland	...	454	198	59	4.9g
Hagerstown	33a	450	235	25	6.5
Montgo'y Cty	659	2,109	922	30	2.8g
MASSACHUSETTS					
Arlington	202	1,241	69	109	1.4g
Attleboro	59ac	713	61	20	2.6
Belmont	58	745	196	18	6.5g
Beverly	101c	1,115	220	17	7.6
Boston	...	20,363	5,444	3,170	6.9
Braintree	66	1,066	109	54	4.7
Brockton	200ac	2,195	352	103	5.2g
Brookline	208	1,418	426	88	7.6
Cambridge	567c	3,113	666	404	5.5
Chelsea	395	445	95	67	2.4
Chicopee	96	775	131	29	2.6g
Everett	324c	1,552	133	94	2.9
Fall River	155e	1,841	412	163	3.7g
Fitchburg	195ce	1,827	105	31	2.5g
Framingham	...	...	...	...	..
Gloucester	829a	1,045	198	26	7.9
Haverhill	318c	1,849	503	159	10.7
Holyoke	155	1,217	564	60	10.3g
Lawrence	369ace	2,063	327	131	3.9
Leominster	...	...	...	...	..
Lowell	307c	2,119	655	128	6.8
Lynn	...	3,437	644	251	6.5
Malden	587a	1,611	152	68	2.5g
Medford	...	...	...	...	..
Melrose	73c	755	23	38	0.9
Methuen	75	773	118	39	4.8
Milton	71	726	85	43	3.8
New Bedford	218b	1,007	314	87	2.9
Newton	215a	1,998	527	74	6.5
North Adams	65	454	148	20	6.9
Northampton	64c	567	284	30	9.5g
Peabody	215a	952	156	20	6.9
Pittsfield	383b	975	363	37	6.6g
Quincy	391a	2,780	404	229	4.8g
Revere	270	1,492	64	166	1.6g
Salem	101	1,295	159	51	3.8
Somerville	659	2,038	359	264	3.5
Springfield	1,690a	4,141	696	487	4.2g
Taunton	69	856	177	59	4.3g
Waltham	153	1,368	235	110	4.4g
Watertown	153	1,034	142	65	3.8
Wellesley	34b	680	44	29	1.9g
Westfield	...	...	...	...	..
W. Springfield	197e	584	126	40	5.5g
Weymouth	71a	1,155	90	54	2.0g
Woburn	122	1,203	49	58	1.6g
Worcester	1,000a	4,838	1,040	565	5.1g
MICHIGAN					
Ann Arbor	47	513	73	10	1.2g
Battle Creek	252	800	185	110	3.8
Bay City	563	904	353	24	6.4g
Dearborn	414	1,042	214	151	1.6g
Detroit	8,570ac	16,612	5,161	2,764	2.7g
East Detroit	49	153	130	...	6.1
East Lansing	13	260	27	8	1.2g
Ferndale	20	357	84	38	2.5g
Flint	921c	2,186	1,243	207	6.3g
Grand Rapids	1,669	1,533	148	162	0.8g
Hamtramck	200a	685	...	...	..
Highland Park	127c	814	217	80	4.7
Jackson	207c	1,369	350	68	6.9
Kalamazoo	280c	921	187	41	3.7
Lansing	387c	2,957	343	100	3.4g
Lincoln Park	30	606	124	109	2.4g
Monroe	61	243	77	25	3.6
Muskegon	67	583	286	47	5.6g
Pontiac	371	1,624	354	201	4.8
Port Huron	184	645	118	9	3.3
River Rouge	235	701	87	17	4.3
Royal Oak	142	887	235	124	3.1g
Saginaw	228ac	1,635	241	86	2.4g
Wyandotte	256	458	138	64	3.8

a. Estimated. b. Incomplete. c. Building and contents only. e. Subject to change.
g. Based on 1957 population estimate.

	Total Loss in 1,000's	No. Alarms	Bldg. Fires	False Alarms	Bldg. Fires/ 1,000 Pop.
MINNESOTA					
Austin	56	166	100	9	4.3
Duluth	273	1,463	599	86	5.7g
Minneapolis	1,802	4,366	860	415	1.6g
Rochester	11	462	209	90	7.0
St. Cloud	356c	252	130	11	5.7
St. Louis Park	62	348	122	0	5.5
St. Paul	1,687a	3,564	1,281	433	3.8g
Winona	21	282	132	32	5.3
MISSISSIPPI					
Biloxi	42	240	88	13	2.4
Greenville	72c	345	253	19	8.5
Gulfport	...	460	81	29	2.5g
Hattiesburg	121	447	120	15	4.1
Jackson	180	896	441	91	4.5
Laurel	162	330	142	14	1.3
Meridian	95	384	192	41	4.6
Natchez	213	562	120	9	3.0g
Vicksburg	55	289	42	20	1.5
MISSOURI					
Cape Girardeau	90	317	106	9	4.9
Columbia	99	356	61	7	1.9
Hannibal	161	209	101	...	4.9
Independence	60	614	165	8	3.0g
Jefferson City	265c	486	131	18	3.9g
Joplin	116c	670	201	36	5.4
Kansas City	1,742	4,994	1,807	371	3.5g
St. Joseph	...	...	...	...	..
St. Louis	...	...	...	...	..
Sedalia	144	354	66	2	2.6g
Springfield	590	1,142	448	67	4.6g
University City	22	994	44	14	0.8g
Webster Grove	31c	344	93	7	3.4g
MONTANA					
Billings	408	361	51	5	1.1g
Butte	...	...	...	...	..
Great Falls	126	585	193	51	3.1g
Missoula	85	369	51	26	2.3
NEBRASKA					
Grand Island	145	972	167	...	6.7g
Hastings	79	211	77	3	3.5g
Lincoln	3,358c	1,057	402	26	4.1
Omaha	1,183	2,071	942	45	3.2g
NEVADA					
Las Vegas	178c	841	155	50	6.3
Reno	2,571f	1,053	351	15	6.4g
NEW HAMPSHIRE					
Concord	117c	314	31	8	1.1g
Manchester	243bc	1,341	251	64	3.0g
Nashua	466ac	613	259	17	7.5
NEW JERSEY					
Atlantic City	1,107	891	413	107	6.7
Bayonne	...	1,000	164	61	2.0g
Belleville	21c	543	26	75	0.8
Bloomfield	...	...	...	...	..
Camden	486c	2,086	449	235	3.3g
Clifton	203	932	111	29	1.7
East Orange	96c	921	268	63	3.4
Elizabeth	788	1,494	141	100	1.2g
Englewood	...	411	178	42	6.7g
Fair Lawn	...	...	...	...	..
Garfield	12c	127	44	...	1.6
Hackensack	351c	554	67	28	2.1g
Hillside	30	363	117	1	5.6
Hoboken	110c	1,100	344	74	6.8g
Irvington	37	410	44	6	7.4
Jersey City	760	2,646	1,364	316	4.5g
Kearny	190	518	109	30	2.7
Linden	512	674	219	21	7.2
Long Branch	112e	465	90	11	3.0g
Maplewood	35	301	83	20	3.3
Montclair	275	620	221	28	5.0g
Newark	3,240	6,812	2,766	816	6.3
New Brunsw'k	335c	573	154	34	3.9g
N. Bergen Twp	468	158	...	...	..
Nutley	105	395	42	17	1.6
Orange	169	653	169	57	4.4
Passaic	237d	823	323	51	5.5
Paterson	...	1,994	927	88	6.7
Perth Amboy	...	...	...	...	..
Plainfield	...	589	191	18	4.5
Rahway	24	367	84	9	3.8g
Teaneck Twp	86	818	121	11	3.0g
Trenton	584e	1,467	513	184	3.9g
Union City	366c	1,039	185	45	3.3
Union Twp	120	710	184	5	3.7g
W. New York	141c	665	160	26	4.1g
Westfield	...	...	...	...	..
West Orange	...	...	...	...	..
NEW MEXICO					
Albuquerque	641	1,084	499	141	2.8g
Roswell	66	341	165	14	6.5
Santa Fe	13	154	79	8	2.4g
NEW YORK					
Albany	557c	1,952	796	428	5.9
Amsterdam	74c	281	78	17	2.4
Auburn	63ac	333	147	22	4.0
Binghamton	453	874	212	49	2.6
Buffalo	3,268ae	8,627	1,266	521	2.1g
Cohoes	291	568	82	13	3.9
Elmira	248c	513	250	24	4.7g
Endicott	28c	206	59	17	2.9g
Freeport	...	...	...	...	..
Gloversville	77	287	77	13	3.3
Hempstead	...	...	...	...	..
Irondiqu't Twp	...	...	...	...	..
Ithaca	124	154	40	8	1.4
Jamestown	226c	671	154	37	3.6
Kenmore	48	241	31	13	1.4g
Kingston	62c	462	164	24	5.7

a. Estimated. b. Incomplete. c. Building and contents only. d. Insured loss only. e. Subject to change. f. Includes $2,000,000 gas explosion. g. Based on 1957 population estimate.

	Total Loss in 1,000's	No. Alarms	Bldg. Fires	False Alarms	Bldg. Fires/ 1,000 Pop.
NEW YORK (Continued)					
Lackawanna	92c	669	104	140	3.8
Lockport	81	419	115	21	4.1g
Middletown	15	309	87	13	3.9
Mount Vernon	275	1,100	212	59	3.0
Newburgh	...	...	...	...	..
New Rochelle	505a	820	311	26	5.2
New York	22,457c	76,997	22,415	12,338	2.8g
Niagara Falls	91	1,403	299	99	3.3
N. Tonawanda	200	365	76	11	3.1
Olean	135	297	32	15	1.4g
Oswego	34c	219	88	18	3.9
Port Chester	126	36	19	...	0.8
Poughkeepsie	...	...	...	...	..
Rochester	692c	3,710	886	373	2.7g
Rockville Ctr.	352	185	56	13	2.2g
Rome	295cd	535	411	45	9.5
Schenectady	...	...	...	...	..
Syracuse	1,494	2,018	862	215	3.9
Troy	175c	1,525	518	49	7.2
Utica	354	830	230	59	2.3
Valley Stream	...	...	...	...	..
Watertown	185c	483	157	41	4.6
White Plains	...	...	...	...	..
Yonkers	919	2,440	627	72	3.5g
NORTH CAROLINA					
Asheville	203c	587	57	70	1.1
Burlington	71	456	64	34	2.2g
Charlotte	...	...	...	...	..
Durham	239c	754	473	74	6.0g
Fayetteville	280	700	281	99	8.1
Gastonia	99c	421	176	40	5.0g
Goldsboro	202	848	260	30	12.1
Greensboro	237c	1,156	518	148	7.0
High Point	162	700	311	55	7.8
Raleigh	190	883	374	170	4.6g
Rocky Mount	32	376	75	28	2.7
Wilmington	41	747	519	81	11.6
Wilson	32a	384	190	83	6.3g
Winston-Salem	308	1,339	421	118	4.8
NORTH DAKOTA					
Fargo	89	581	143	21	3.8
Grand Forks	358	263	168	15	4.8g
Minot	206	242	97	2	3.4g
OHIO					
Akron	1,851a	2,768	759	343	2.8
Alliance	68	174	68	...	2.1g
Ashtabula	194	323	115	20	4.6g
Barberton	33	412	100	67	3.6
Canton	416c	1,112	254	175	2.2
Chillicothe	56	518	77	9	3.8
Cincinnati	1,320	5,735	2,037	589	3.7g
Cleveland	7,021a	10,188	2,887	1,450	3.2
Cleveland Hts.	106	1,021	233	7	4.0
Columbus	...	...	...	...	..
Cuyahoga Falls	48b	403	85	52	2.0g
Dayton	255	6,614	588	402	2.4
East Cleveland	48	504	79	13	1.9g
East Liverpool	396cd	465	135	9	5.6
Elyria	348	...	...	...	..
Euclid	95	548	194	13	3.2g
Findlay	229	337	171	13	7.2
Garfield Hgts.	80	242	73	6	2.5g
Hamilton	71	1,546	283	61	4.9
Lakewood	113	229	68	49	1.0
Lancaster	76	321	86	18	3.6
Lima	680	611	295	36	5.3g
Lorain	1,685	702	135	64	2.7
Mansfield	221c	648	283	53	6.5
Marion	48	568	89	12	2.4g
Massillon	199c	340	129	36	4.3g
Middletown	160	604	186	37	5.5
Newark	111	769	28	55	0.7g
Norwood	26	213	106	13	3.1
Parma	81	1,116	64	10	0.9g
Portsmouth	262	332	102	71	2.8
Sandusky	107	662	189	8	6.1g
Shaker Heights	51	605	417	9	12.6g
Springfield	62	905	419	68	5.4
Steubenville	53c	509	96	72	2.6g
Toledo	878	2,519	901	256	2.7g
Warren	514	599	135	38	2.2g
Youngstown	197	1,905	423	188	2.5g
Zanesville	51	401	174	66	3.9g
OKLAHOMA					
Enid	76	421	166	22	4.0g
Lawton	174	614	247	30	4.3g
Muskogee	197c	655	83	34	1.8g
Norman	74c	343	71	2	2.1g
Oklahoma City	1,102	3,257	972	241	3.3g
Ponca City	99	327	100	5	5.0
Shawnee	75ac	267	37	5	1.5
Stillwater	55	187	99	1	4.9
Tulsa	556	2,744	869	211	4.8
OREGON					
Eugene	106c	683	567	19	15.9
Portland	1,706a	4,257	2,408	165	6.0g
Salem	...	472	298	13	6.9
PENNSYLVANIA					
Aliquippa	274	247	96	27	2.7g
Allentown	116	589	269	28	2.4g
Altoona	166	851	298	87	3.9
Bethlehem	40c	445	103	48	1.4g
Butler	57	745	400	6	1.6
Chelt'h'm Twp	...	...	...	...	..
Chester	304	875	254	79	3.5g
Dunmore	...	...	...	...	..
Easton	256c	197	107	10	3.0g
Erie	...	...	...	...	..
Harrisburg	60e	652	379	53	4.1g
Haverford Twp	74	436	95	4	1.7g
Hazleton	89	168	60	4	1.7
Johnstown	14	962	230	94	3.7g

a. Estimated. b. Incomplete. c. Building and contents only. d. Insured loss only. e. Subject to change. g. Based on 1957 population estimate.

	Total Loss in 1,000's	No. Alarms	Bldg. Fires	False Alarms	Bldg. Fires/ 1,000 Pop.
PENNSYLVANIA (Continued)					
Kingston	355	113	16	37	0.8g
Lancaster	64	431	246	74	3.9
Lebanon	12	147	52	3	1.8
Lower Merion T	541	862	236	4	4.8
McKeesport	55	729	279	119	5.4
Mt. Lebanon T	36a	250	92	1	2.7g
Nanticoke	...	...	...	...	..
New Castle	86	573	215	60	4.4
New Kensing'n	...	...	...	...	..
Norristown	...	...	...	...	..
Philadelphia	...	32,401	6,121	3,326	2.8g
Pittsburgh	...	...	...	...	..
Pottstown	112c	220	...	7	..
Pottsville	39	129	36	6	1.3g
Reading	...	...	...	...	..
Scranton	590c	1,152	294	112	3.2
Sharon	...	...	...	...	..
Uniontown	...	254	64	23	2.8g
Upper Darby T	221	651	189	7	2.0g
Washington	120	301	128	16	4.9
Wilkes-Barre	395	702	162	60	2.1g
Wilkinsburg	20	318	159	24	4.5g
Williamsport	98c	376	128	12	2.9
York	265	322	141	48	2.2g
RHODE ISLAND					
Central Falls	80c	396	83	18	3.5
Cranston	...	...	...	...	..
E. Providence	111	738	92	63	0.8g
Newport	42	387	194	25	5.2g
Pawtucket	536	1,998	355	126	4.4
Providence	1,294	8,400	393	460	1.7
Warwick Twp.	224	2,155	232	88	5.4
Woonsocket	106	956	182	153	3.6g
SOUTH CAROLINA					
Charleston	179c	1,172	468	433	6.5g
Columbia	388c	1,278	714	109	6.3g
Greenville	232	947	387	128	5.7g
Spartanburg	93	575	110	84	2.2g
SOUTH DAKOTA					
Rapid City	174	549	50	6	1.2g
Sioux Falls	118	502	128	3	2.0g
TENNESSEE					
Chattanooga	940	2,288	891	489	5.7g
Jackson	158	401	...	...	..
Johnson City	43	369	167	8	5.2g
Knoxville	186	1,750	553	116	4.3g
Memphis	...	...	...	...	..
Nashville	660c	2,752	1,004	318	5.6g
TEXAS					
Abilene	350c	809	295	76	4.2g
Amarillo	473c	1,043	186	93	2.5
Austin	236c	1,948	324	20	1.7g
Baytown	55c	217	89	6	2.5g
Beaumont	302ac	1,198	441	53	3.6g
Brownsville	26e	226	94	48	2.6
Brownwood	36	1,373	16	108	0.8
Corpus Christi	430cd	1,189	416	81	3.8
Dallas	3,358c	7,705	1,769	316	4.1
Denton	86c	210	99	...	4.6
El Paso	188a	2,037	442	238	1.8g
Fort Worth	1,454	4,013	1,340	491	4.8
Galveston	...	...	...	...	..
Harlingen	58c	339	121	17	3.4g
Houston	4,206ac	8,501	2,734	1,222	4.6
Laredo	79	383	80	47	1.3g
Longview	96c	342	112	0	4.6
Lubbock	200ac	1,430	511	53	3.7g
Marshall	108ac	269	42	10	1.9
McAllen	7	146	53	42	2.6
Midland	282c	443	209	48	4.0g
Odessa	148c	649	325	28	11.0
Orange	85c	261	83	29	2.6g
Paris	51c	303	129	4	6.0
Pasadena	76	298	103	5	1.9g
Port Arthur	91	575	70	103	1.1g
San Angelo	282c	...	420	...	6.5g
San Antonio	889	5,037	1,387	263	3.4
Sherman	89ce	285	145	13	5.2g
Temple	...	555	34	12	1.4
Texarkana	...	...	...	...	..
Tyler	320c	512	138	13	3.5
University Pk.	68c	62	31	1	1.0g
Waco	152	731	361	31	2.9g
Wichita Falls	250ac	1,213	334	122	3.5g
UTAH					
Ogden	219	1,445	219	98	3.4g
Provo City	45	433	69	4	2.4
Salt Lake City	466	2,703	617	160	2.9g
VERMONT					
Burlington	...	680	336	53	10.2
VIRGINIA					
Alexandria	200c	4,109	460	90	7.5
Arlington Cty.	271	1,624	876	50	6.4
Charlottesville	21c	328	119	10	4.0g
Danville	104	493	187	46	3.8g
Hampton	320	890	277	44	3.5g
Lynchburg	234	841	285	98	6.0
Newport News	195	766	317	89	6.3g
Norfolk	1,590	4,160	1,033	649	3.4g
Petersburg	61	781	391	85	11.2g
Portsmouth	1,168	1,235	302	130	3.4g
Richmond	...	...	...	...	..
Roanoke	445a	1,159	427	137	4.1g
Warwick	13	642	321	14	4.6g
WASHINGTON					
Bellingham	75	722	106	22	2.8g
Bremerton	18	397	234	35	8.4
Everett	60c	728	212	58	6.3
Longview	28c	482	241	49	10.4g
Seattle	719c	7,645	1,044	373	2.3

a. Estimated. c. Buildings and contents only. d. Insured loss only. e. Subject to change.
g. Based on 1957 population estimates.

	Total Loss in 1,000's	No. Alarms	Bldg. Fires	False Alarms	Bldg. Fires/ 1,000 Pop.
WASHINGTON (Continued)					
Spokane	2,634c	2,448	1,388	173	7.3g
Tacoma	445	2,166	1,001	155	6.4g
Vancouver	142c	490	239	34	8.6
Walla Walla	115cd	526	252	45	9.9g
Yakima	155	671	298	15	6.9g
WEST VIRGINIA					
Bluefield	32	155	...	13	..
Charleston	312c	968	263	193	3.6
Clarksburg	...	...	...	...	..
Fairmont	214c	796	126	3	4.2g
Huntington	274	1,517	334	180	3.5g
Morgantown	62c	351	142	19	5.6
Parkersburg	166ac	378	98	31	1.7g
Weirton	224	200	43	3	1.8
Wheeling	503	2,114	263	26	4.5
WISCONSIN					
Appleton	272	555	254	36	7.5
Beloit	41	394	175	57	5.9
Eau Claire	49a	420	151	88	3.9g
Fond du Lac	35e	348	163	35	4.9g
Green Bay	1,536	1,147	280	66	4.7g
Janesville	44	743	40	50	1.3g
Kenosha	164	1,037	264	40	4.9
La Crosse	40	729	74	5	1.6g
Madison	165e	772	351	42	2.9g
Manitowoc	86	405	142	52	4.8g
Milwaukee	...	...	...	...	..
Oshkosh	77	550	191	32	4.2g
Racine	364	1,963	218	57	2.6g
Sheboygan	59	472	309	31	6.9g
Superior	175	658	283	32	6.8g
Waukesha	...	...	...	...	..
Wausau	39	534	216	37	7.1
Wauwatosa	47	755	173	17	5.2
West Allis	99	920	144	5	2.3g
WYOMING					
Casper	131	389	201	14	6.0
Cheyenne	70	352	74	19	2.1g

1957 FIRE LOSSES, CANADIAN CITIES

	Total Loss in 1,000's	No. Alarms	Bldg. Fires	False Alarms	Bldg. Fires/ 1,000 Pop.
ALBERTA					
Calgary	428	1,819	404	189	3.0
Edmonton	949	1,916	676	297	2.8g
Lethbridge	325	256	79	15	2.5g
BRITISH COLUMBIA					
Burnaby	333	965	109	8	1.2g
New Westmin'r	38	421	286	45	7.9g
Saanich	91	677	216	12	9.0
Vancouver	2,453e	5,847	2,218	202	5.4g
Victoria	1,274	842	493	83	9.7
MANITOBA					
Brandon	152	308	80	19	3.1g
St. Boniface	172	406	176	85	6.7
Winnipeg	612a	3,122	443	781	1.7g
NEW BRUNSWICK					
Moncton	...	...	...	...	..
Saint John	552	1,527	688	140	10.9
NOVA SCOTIA					
Glace Bay	42c	186	42	15	1.5
Halifax	398	1,786	953	76	8.9g
Sydney	...	...	...	...	..
ONTARIO					
Brantford	116c	507	233	7	4.5g
Chatham	...	...	...	...	..
East York Twp	83	364	40	15	5.8g
Etobicoke	408a	838	221	48	2.0g
Fort William	71	523	366	26	12.0
Galt	56	273	141	12	6.1
Guelph	105c	442	271	2	7.8g
Hamilton	1,309	2,330	504	109	2.0g
Kingston	381	821	467	51	9.5g
Kitchener	90	435	61	4	1.0g
London	237c	968	337	27	3.3g
Niagara Falls	171c	190	124	22	5.2g
N. York Twp.	353a	1,288	492	32	2.7g
Oshawa	207	549	71	57	1.4g
Ottawa	1,917	2,677	1,499	175	6.8g
Peterboro	...	...	...	...	..
Port Arthur	105	659	240	75	7.5
St. Catharines	35c	443	301	23	7.9
Sarnia	...	...	...	...	..
Sault Ste. Marie	67c	467	104	18	2.6g
Scarboro Twp.	1,231	1,187	298	101	2.0g
Sudbury	222c	512	95	5	1.9
Timmins	81	581	69	20	2.5g
Toronto	3,658c	9,034	2,706	879	4.1
Windsor	937	1,269	548	139	4.3g
York Twp.	479	818	229	46	1.8g
QUEBEC					
Chicoutimi	...	...	...	...	..
Hull	144	1,005	381	206	7.6g
Jonquiere	...	355	46	97	1.6g
Lachine	444	468	45	58	1.3g
Montreal	8,787e	15,675	2,779	4,466	2.0g
Outremont	208c	...	283	...	8.8
Quebec	2,103	2,439	374	645	1.6g
Shaw'gan Falls	143	324	16	45	0.4
Sherbrooke	700bc	817	573	94	9.4g
Three Rivers	...	...	...	...	..
Verdun	246	923	392	127	5.0
Westmount	623	389	72	48	2.5g
SASKATCHEWAN					
Moose Jaw	41	408	114	62	3.8g
Regina	246	1,063	422	208	6.0
Saskatoon	116c	648	307	122	5.8

a. Estimated. b. Incomplete. c. Buildings and contents only. d. Insured loss only. e. Subject to change. g. Based on 1957 population estimate.

Reviews and Abstracts of Technical Papers

It is NFPA policy to publish in the QUARTERLY significant technical papers which are available dealing with fire subjects. For various reasons many valuable papers cannot be published in full. This department is to review or abstract some papers which otherwise might not be available to readers.

NFPA members are often advised in FIRE NEWS about papers which appear in a publication which can be readily obtained by purchase. Publications listed in FIRE NEWS would not necessarily also be listed in this department.

Members are invited to submit reviews or abstracts of papers which merit mention here. Where possible a copy of the original paper should accompany the review or abstract. Minimum information which should be provided about each paper is its title, name of authors, name of publication in which it appeared, name and mail address of publisher, date, number of pages and price (if one is stated).

Some papers reviewed or abstracted will be from periodicals which are often available only on a subscription basis. In some cases only limited copies of particular papers may be available. The review or abstract, however, may enable members interested to secure copies which will be in the files of various libraries. Most authors would try to furnish copies to other technical people working in the same area, and arrangements can sometimes be made to obtain copies from the source mentioned or on a loan basis. The NFPA library will usually have copies on file but will not be able to lend library file copies.

This department is an experiment which will be continued in future issues of the QUARTERLY if it appears to serve a useful need. Its regular publication will depend on members' interest and support.

Terra-Incognita: the Surface of a Reacting Solid. Prof. J. S. Anderson, Department of Chemistry, University of Melbourne. Report of the 32nd Conference, Dunedin (New Zealand), Australian and New Zealand Association for the Advancement of Science. January, 1957. The Australian Journal of Science, Science House, 157–161 Gloucester Street, Sydney, NSW. January, 1957, issue (Vol. 19, No. 3a, page 27).

The author catalogs a variety of heterogeneous surface reactions and speculates on the real nature of a solid surface. These speculations would be of interest to persons concerned with metal pyrophoricity and perhaps other subjects.

The Feasibility of Extinguishing Fire Storms by Explosive Means. Donald L. Martin, Assistant Project Engineer, Special Projects Branch, Military Engineering Department, U. S. Army Engineer Research and Development Laboratories. A technical memorandum published by U. S. Army Engineer Research and Development Laboratories, Corps of Engineers, Fort Belvoir, Virginia. March, 1957. 26 pages.

This paper describes a small-scale test conducted to determine the effects of explosive air blast phenomena on fire storms. Such fire storms were developed on "candle boards" (masonite boards holding 2,400 candles in upright posi-

tion). This method of demonstrating a fire storm was developed by Mr. Ralph Healy, Civil Defense Activities Engineer of the New York Telephone Company, at the suggestion of Horatio Bond, Chief Engineer, National Fire Protection Association.

In the series of small-scale tests by the Special Projects Branch, ¼-pound charges of high explosives were detonated at various heights (ranging from 2 to 8 feet from the candle boards) above the fire storms. The small fire representing the fire storm was not extinguished in any test run. High speed motion pictures indicated the development of a fireball at the candle board which expands to several thousand times the volume of the original fire storm. This secondary fireball develops independently of the explosive fireball.

Photographs included in the report show graphically how the use of explosives creates vastly worse conditions than if the fire storm is allowed to burn by itself.

Considerations Nouvelles sur la Deflagration des Melanges Gaseux et son Charactere de Reaction en Chaines (New Considerations Concerning the Deflagration of Gaseous Mixtures and its Character of Chain Reactions.) A. Van Tiggelen, J. Van Wonterghem and J. Vaerman. The authors are associated with the Inorganic and Analytic Chemistry Laboratory of the University of Louvain, 98 Rue de Namur, Louvain, Belgium. The paper appeared in Compte Rendu du XXVII[e] Congrès International de Chimie Industrielle, Bruxelles, 11-20 September, 1954. It has been translated from the original French for the Fire Fighting Branch, U. S. Army Research and Development Laboratories, Fort Belvoir, Virginia, and appears in a document identified ERD CE-A1 8-76-04-216, 1 October, 1957. Filed with the Fire Fighting Branch.

The purpose of the paper is to define certain fundamental principles which have served as an elementary theory of fire propagation in gaseous mixtures and then to show that for the usual fire reactions the chemical mechanism to be brought forth is the chain reaction, the only one capable of accounting for the very rapid chemical transformation produced in the fire.

Brandoverslag door straling. (Fire Spread by Radiation), Ir Lie Tiam Tjoan, Physicist. Brandveiligheidsinstituut T.N.O. (The Dutch Fire Research Institute), Postbus 49, Delft, The Netherlands, 13 March, 1957. 8 by 11¾ inches, 12 pages and paper cover.

This paper reports some elementary studies of how a radiant heat source in the form of a vertical plane imposes heat radiation intensities on other planes at varying distances, the receiving plane being at various angles between the perpendicular and the horizontal with respect to the vertical plane heat source. The paper describes the small-scale laboratory apparatus used, gives the mathematical calculations which apply, lists the critical intensities of heat radiation in calories per square centimeter per second which are needed for ignition and presents the results of the experiments in tables and charts.

Fire in Wooden Construction. Dr. Kinichiro Fujita, Tokyo University. Dr. Fujita is former director of the Japanese Building Research Institute and has prepared a number of papers on radiation heat and its effect on the spread of fire between houses of wooden construction of the type common in Japanese cities. This paper is an English translation of one which summarizes this work. It appears in a blueprint reproduction of typewritten copy in a ten-page paper issued by the Japanese Building Research Institute, 4 Chome, Hyakunin-Cho, Shinjuku-Ku, Tokyo, Japan.

Dr. Fujita briefly summarizes the fire tests on which the data are based, describes combustible materials in a wooden house, observed fire growth, room temperature and the temperatures of the wall of buildings exposed by the dwelling fire. From these data he deduces safe distances between the exposed and exposing walls of dwellings to avoid fire spread.

Fire Tests of Building Materials. Dr. Minoru Hamada of Tokyo University. This paper appeared in the Report of the Japanese Building Research Institute, No. 15, March, 1955, published by the Building Research Institute, 4 Chome, Hyakunin-Cho, Shinjuku-Ku, Tokyo, Japan.

This paper reports the results of fire tests on boards and wall assemblies which have been carried out at the Building Research Institute between 1950 and 1953. Many of the tests were small-scale, but the results are presented for a considerable variety of wall finish and wall assemblies of the sort used in Japanese building construction. The paper is in Japanese, but there is a good abstract in English and the data are easy to follow.

Experimental Fire in a Light-Weight Steel Construction. Kunio Kawagoe and Yoshio Yoshiura. Mr. Kawagoe is a Research Member of the Japanese Building Research Institute, and Mr. Yoshiura is with the Tokyo Metropolitan Fire Board. The paper is a blueprint reproduction of a typewritten manuscript in English including a number of diagrams, tables and photographs of a special structure in which the experimental fire was carried out. The paper is released by the Japanese Building Research Institute, 4 Chome, Hyakunin-Cho, Shinjuku-Ku, Tokyo, Japan.

The investigation was to determine the fire resistance of prestressed concrete louver board and a steel rolling fire door as well as general behavior of fire in a room. The data include time-temperature curves, percentage of carbon monoxide and carbon dioxide in the room and detailed behavior of the prestressed boards.

Essais d'Incendie dans des Immeubles Réels a l'Usage d'Habitation (Fire Test in the Contents of a Dwelling.) Colonel J. Besson and J.-P. Fackler. Colonel Besson is Commandant of the Régiment de Sapeurs-Pompiers of the City of Paris (the Paris Fire Department). Mr. Fackler is Chief of Service at the French Building Research Center. Their paper is published in Cahier 245 of *Cahiers du Centre Scientifique et Technique du Bâtiment No. 29* published by Centre Scientifique et Technique du Bâtiment, 4 Avenue du Recteur-Poincaré, Paris 16, France. Address CSTB for information as to the availability of the paper.

The circumstances of a series of tests in an actual dwelling house occupancy are reported with detailed information as to the nature and disposition of the contents and time-temperature readings taken during each test. One purpose of the test was to determine the size of rooms to be used in reproducible tests in dwelling occupancies. The authors report that the tests indicate that a compartment about 4 by 6 meters (13 by 20 feet) would be about right for this purpose. It should be possible to divide it into two approximately equal compartments with an easily removable board floor.

Methods of Testing Thermocouples and Thermocouple Materials. William F. Roeser and S. T. Lonberger. National Bureau of Standards Circular 590, issued February 6, 1958. Obtainable from U. S. Superintendent of Documents, Washington 25, D. C. 28 pages. 20 cents.

Various methods used for testing thermocouples and thermocouple materials that must be observed in order to attain various degrees of accuracy are described. Consideration is given primarily to the calibration of platinum versus platinum-rhodium, copper-constantan, Chromel-Alumel, and iron-constantan thermocouples.

Mechanical Ventilation and Fog Nozzles. By Robert J. Fitzgerald (2). Mr. Fitzgerald is a fireman in the 3rd Division of the New York City Fire Department. His paper was published in the January, 1958, issue of WNYF (With New York Firemen) Volume 19, No. 1, page 8. WNYF is a periodical published quarterly by and for the members of the New York Fire Department. The editor's address is 42 Great Jones Street, New York 12, New York.

The paper is intended as an introduction to the principles affecting the flow of gases from a fire which fire fighters will find helpful. The use of water streams from fog (spray) nozzles to produce flows of combustion gases is discussed with reference to a number of typical fire situations with which a fire department comes in contact.

The Theory of the Requisite Fire-Resistance Ratings for Proposed Walls Exposed to Heat Radiation from Distant Building Fires. By J. H. Clarke of the Australian Commonwealth Experimental Building Station, Box 30, P. O., Chatswood, New South Wales. The paper appears as an unpublished report of the Station, Technical Record File No. BS 44/153/210(L), 16 mimeographed pages and two plates.

The paper is devoted to the problem of determining what the fire-resistance rating should be of the outside wall of a building which is exposed by a neighboring building. The work presents information on the relationships between the heat flux received which is absorbed by brick or concrete surfaces and a value for a configuration factor at the center of the exposed surface. The values of the configuration factor are then related to the ratio of the fire resistance required in exposing and exposed walls of buildings.

The material is based on other studies made by the Experimental Building Station and also on the work by R. C. Bevan and C. T. Webster which was reported in "Investigations on Building Fires, Part 3, Radiation from Building Fires" National Building Studies, Technical Paper No. 5, issued in 1950 by Her Majesty's Stationery Office in London. Persons familiar with Bevan's and Webster's work will appreciate the additional investigations reported in Mr. Clarke's paper.

Burning Speed of Fibre Surface. By Yorio Yazi. This paper appeared in the Bulletin of the Fire Prevention Society of Japan, November, 1957, Volume 7, No. 1, page 25. The Bulletin is published by the Fire Prevention Society of Japan at the Institute of Engineering, University of Tokyo, Hongo, Tokyo, Japan. The paper is in Japanese. Photographs and diagrams accompanying the paper are captioned in English, and there is an English summary of the paper itself.

It describes experiments investigating the burning speed of staple cotton fibres placed on a rotating drum with variations in the burning angle and the water content. It was found that flame-spread was very great at about 60 degrees and much less at smaller angles. Water content of the sample decreased surface burning speed, and this effect was greater at the larger angles between the fibre surface and the heat source.

The Wind Velocity Distribution Along the Axis of Jets. By Sizuo Yokoi of the Japanese Building Research Institute. This paper appeared in the November, 1957, issue of the Bulletin of the Fire Prevention Society of Japan, Volume 7, No. 1, page 20. The Bulletin is published by the Fire Prevention Society of Japan at the Institute of Engineering, University of Tokyo, Hongo, Tokyo, Japan. Diagrams accompanying the paper have English captions, and there is an English abstract of the paper.

The paper discusses the wind velocity distribution along the axis of jets ejected from circular or rectangular orifices. This was investigated to apply the results to a study of the characteristics of a flame issuing from a window in case of a fire in a concrete house, or to those of an upward current from rectangular-shaped heat source.

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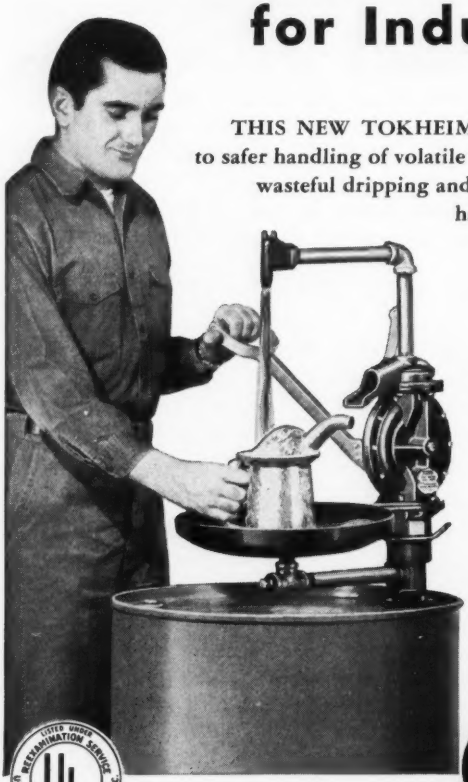

THIS NEW TOKHEIM HAND PUMP contributes to safer handling of volatile liquids wherever used. Stops wasteful dripping and slippery floors. Reduces fire hazard and accidents common to other methods of liquid transfer. Approved for handling petroleum liquids —ideal for many others. Available in 22 different models for 'most any use— from pipe lines to drums, or underground tanks, with hose or spout outlets. Order from your dealer, your oil company, or your Tokheim representative.

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General Products Division

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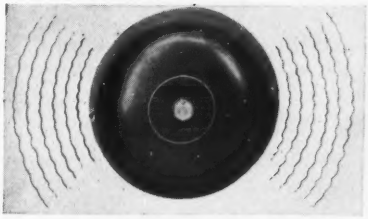
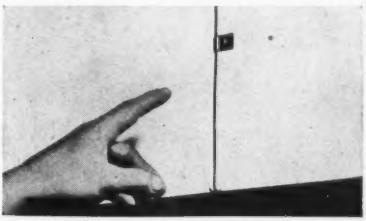
FIRE ALARM!



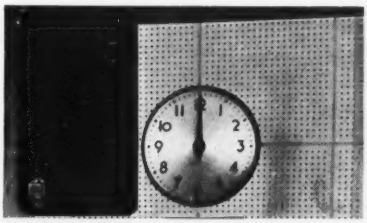
1. Save priceless lives, protect valuable buildings with the Kidde Atmo Fire Detecting and Alarm System!

2. This automatic detecting and warning system sounds an alarm instantly at the *first* hot breath of fire!



3. Using rate-of-temperature-rise tubing as a sensing element, the system works without outside power!

4. Kidde's Atmo system can sound alarm at fire area, outside the building or at local fire department station!



5. Kidde's Atmo system also gives fire location at a panel near any manned telephone switchboard!

Kidde Atmo
FIRE DETECTION
J. H. SCHARFF, INC.
451 Main Street, Orange, N. J.

A Subsidiary of
Walter Kidde & Company, Inc.

FOR fast, dependable fire detection and warning, install a Kidde Atmo Fire Alarm System. Ideal where life protection and early fire warning is essential, the Kidde Atmo system can also close doors, shut off fans, motors, blowers, is automatically re-setting after use or test. Get more information! Write today and ask for Kidde's Atmo Alarm Systems booklet!

Nation Wide
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Sprinkler Valve Alarm — Complete Sprinkler Supervisory — Manual Fire Alarm — Automatic Fire Alarm — Temperature Alarm — Oil Burner Supervision — Burglar Alarm — Hold-Up Alarm — Vault & Safe Protection

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"K" Pipe Lock Couplings

Listed for 800 psi by Underwriters' Laboratories, Inc., these couplings have a safety factor of five times the UL listing for 2½" through 6" and four times UL listing for 8". Sizes: 2½" through 8". Look for the "800 D" on each.

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Pressure rating, 500 psi by Underwriters' Laboratories, Inc. for elbows, base elbows, 45° elbows, side outlet elbows, tees, side outlet tees, and reducers in straight and reducing sizes. Flat faced flanges standard. Extra heavy flange dimensions and raised faces available. Look for the "DI 500" on each.

Complete range of sizes through 12".

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STEAM AND OIL AT 550°F
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*Ductile iron fittings are available in any size in Kuhns complete cast iron line, ¼" through 12".

Note: These fittings are excellent for liquefied petroleum gas systems. Look for the "DI 300" on each.

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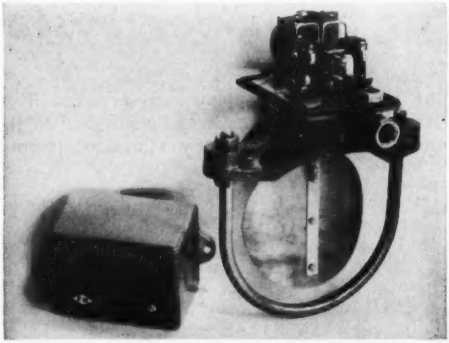

Model PRS-1

Sprinkler

Waterflow Alarm

This device is approved by Factory Mutual Laboratories and Underwriters' Laboratories, Inc.

- This device is also made as Model PRT-1, a coded waterflow transmitter.

5-inch size shown above. To install simply drill 2-inch hole in pipe.

- Also made in explosion proof models.
- Made in all sizes from 2½" to 8".
- Has instantly recycling pneumatic retarding device, which prevents false alarms.
- Has enclosed electrical contacts for any voltage not exceeding 15 amp. 125 volts, A.C. and ½ amp. 125 volts, D.C. Operates on all water pressures or surges.

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Underwriters' Laboratories, Inc. Approved.

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● Since originating the fire and panic exit device in 1908, Von Duprin has consistently pioneered advances in design, use of new materials and a line of auxiliary items to provide "safe exit" for any building, any condition.

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Defective or overloaded wiring is one major cause of industrial fires. Like all fires, they start small but grow rapidly—unless immediately stopped.

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He carries a complete line of quality extinguishers, systems, brass goods, hose and accessories. Or write to:

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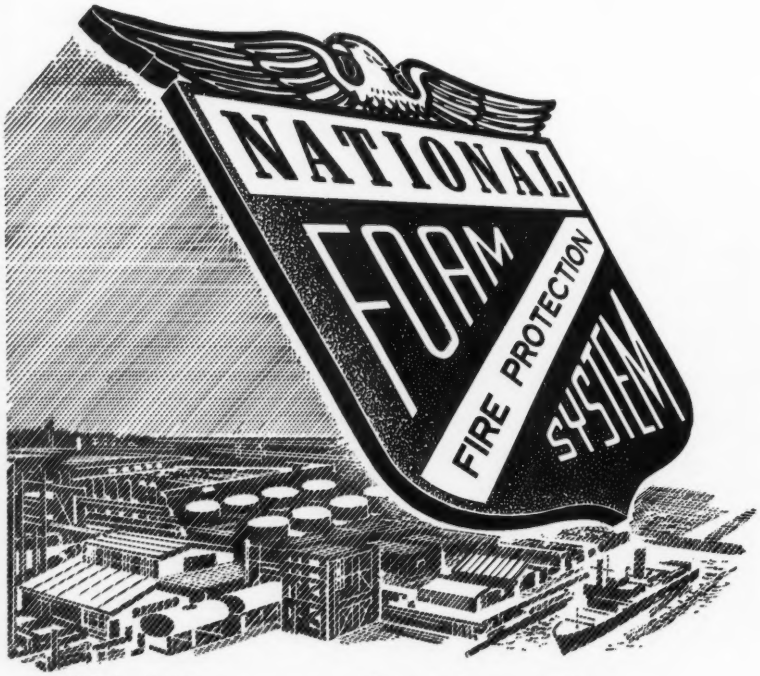

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. . . through skilled engineering

of AER-O-FOAM systems

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National Foam, time and again, has pioneered these developments. Through improvements in mobile systems, for example, National Foam has substantially reduced installation costs in modern foam systems.

Safety engineers know they will get the benefit of up-to-the-minute system design when they call in the National Foam representative.

NATIONAL FOAM System, Inc.

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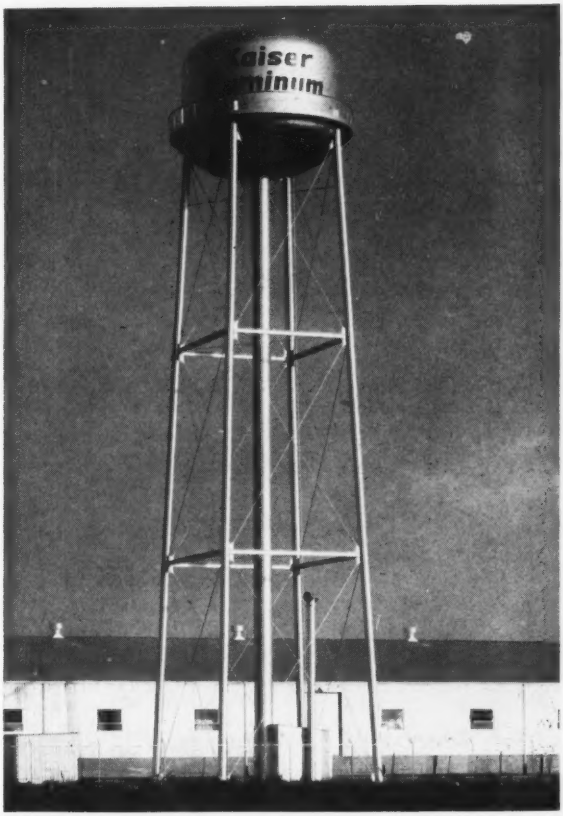

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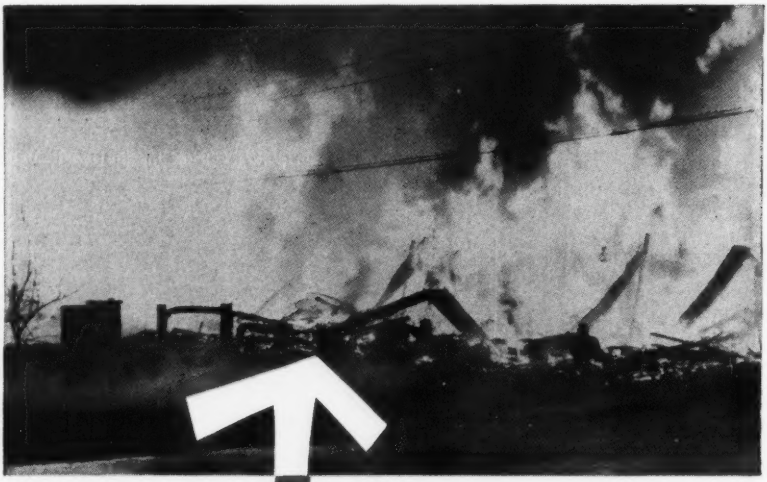
Horton Tank Provides Dual Service and Aids In Insurance Savings

The new food container plant of Kaiser Aluminum and Chemical Corporation, near Wanatah, Indiana, has 50,000 gallons of water for fire protection and 25,000 gallons for general plant use stored in a 75,000 gallon ellipsoidal bottom elevated tank with a height to the bottom capacity line of 100 feet. Studies of insurance savings that would result from the sprinkler protection prompted the decision to erect this tank which is sufficiently large for future plant expansion.



this was so unnecessary

A Blaw-Knox Automatic Sprinkler System could have prevented it

Most uncontrolled fires are unnecessary. The damage in property destroyed, plants lost, inventories wiped out, records ruined, and businesses shut down can never be recovered. A Blaw-Knox *Automatic* Sprinkler System can stop fires at their origin, minimize damage to a small area, and pay for itself in a few years by savings in reduced insurance premiums.

"Little Joey Sprinkler" always on the job.

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829 Beaver Avenue, Pittsburgh 33, Pa.

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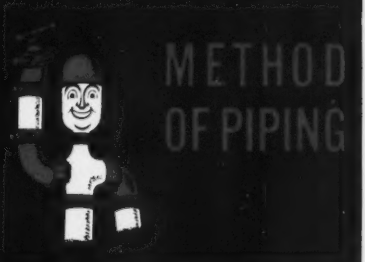
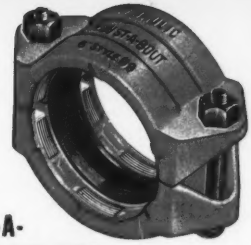


VICTAULIC COUPLINGS

Styles 77, 77-D for standard applications. Simple, fast to install — sturdy and reliable. Sizes ¾" to 30". Style 75 Light-Weight Couplings for light-duty applications. Sizes 2" to 8". Additional styles for cast iron, plastic and other pipes. Sizes through 60".



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Style 99 for plain or beveled end pipe. Best engineered, most useful plain end joint on the market. Simple, husky — easy and fast to install. Takes strong bull-dog grip on pipe. Sizes 2" to 12".

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Handy, on-the-job grooving tools that do the job in half the time. Light weight, easy to handle — operate manually or from any power drive. Automatic groove position and depth. Sizes ¾" to 8".

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Proven for 28 years on both wet and dry Fire Protection Systems. Standard with most major sprinkler companies for bulk-run and cut-in piping. Victaulic Couplings are installed in *less than one-half the time* required for other standard pipe joints.

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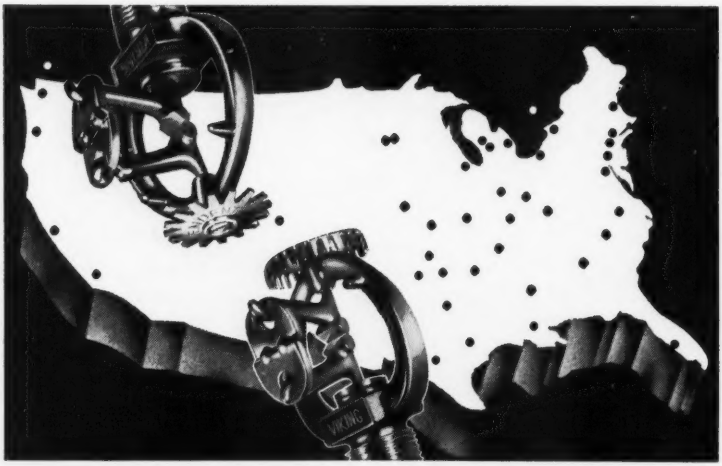

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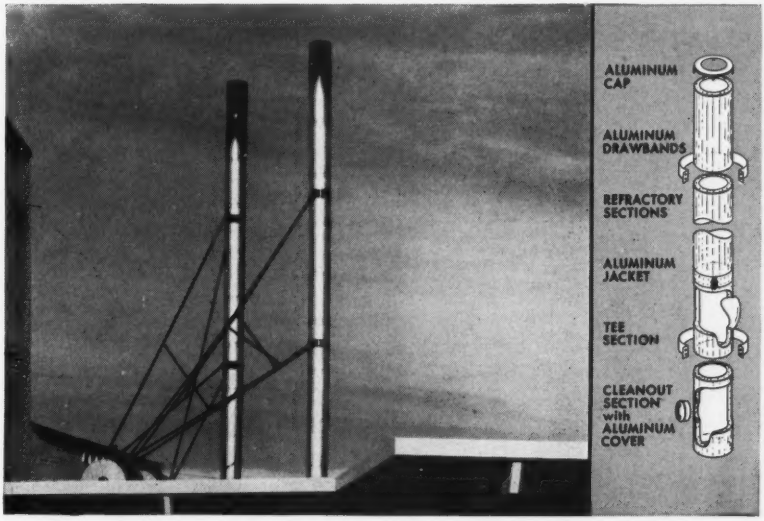

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Permanence — The Van-Packer Industrial Stack is made of 3-foot long, non-corroding refractory sections cemented together with acidproof cement and secured with aluminum joint bands. Sections have maintenance-free aluminum jacket.

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Send for New Flexalarm Manual . . . Easy-to-use technical manual with functional descriptions, typical specifications and data on major components. Get your copy now for time and cost saving on your next project. And for specific technical assistance, ask to see a Gamewell Engineer.

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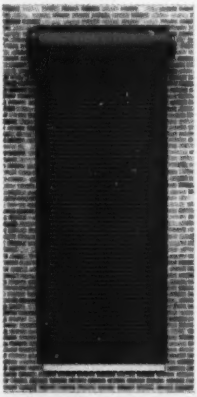
FIRE DOORS *and* WINDOW SHUTTERS
PREVENT SPREAD *of* FIRE!



You need good automatic fire doors in fire walls, corridors, and vertical shafts . . . in some cases automatic rolling steel window shutters are necessary to protect your building and its contents from fires which may originate in nearby buildings. Many, many cases are on file which confirm that timely action of automatic rolling steel fire doors and window shutters have confined a fire to its point of origin and permitted its being extinguished with comparatively small damage. Make a survey of your building now, and don't delay action. You will find a Mahon Automatic Rolling Steel Fire Door or Window Shutter to meet each of your requirements—all bear the Underwriters' Label. These automatic fire doors may be operated manually or mechanically in every day use. If a fire should break out while they are in the open position, the automatic mechanism will close the door, cutting off drafts and preventing the spread of the fire. See Sweet's Files for complete information, or write for Catalog G-58.

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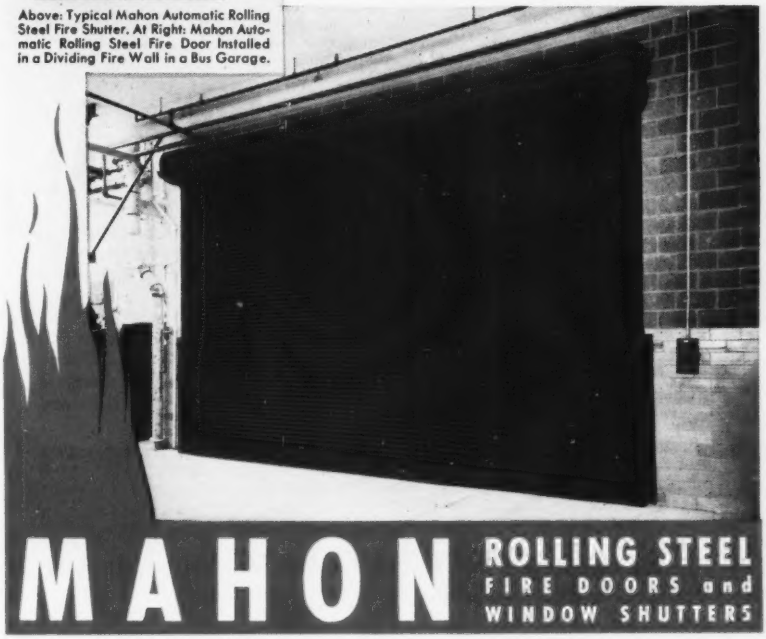
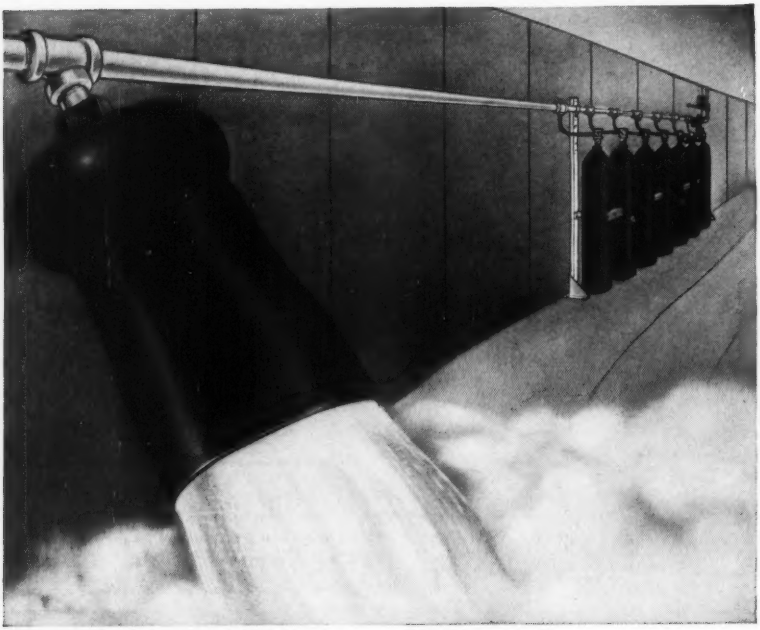
Manufacturers of Standard and Underwriters' Labeled Automatic Rolling Steel Fire Doors and Window Shutters; Underwriters' Rated Metalclad Fire Walls; Insulated Metal Curtain Walls; Electrified M-Floors; Steel Roof Deck, Acoustical Long Span M-Decks; and Acoustical and Troffer Forms.

Above: Typical Mahon Automatic Rolling Steel Fire Shutter. At Right: Mahon Automatic Rolling Steel Fire Door Installed in a Dividing Fire Wall in a Bus Garage.



MAHON ROLLING STEEL FIRE DOORS and WINDOW SHUTTERS



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AUTOMATIC FIRE PROTECTION!

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Kidde systems are pressure-operated, use no falling weights, no clumsy mechanical triggering methods. Special rate-of-temperature-rise detectors trigger the system at the first flash of fire, pneumatic control heads insure instantaneous and complete system discharge. All operating parts are self-enclosed for safety, need no replacement after a fire. Visual indicators show at a glance whether system is "set" or "released," and directional valves allow protection of more than one hazard from the same bank of cylinders.

For more information on Kidde systems, and how they give the best protection from fire, write today for Kidde's Engineered Fire Equipment Booklet.

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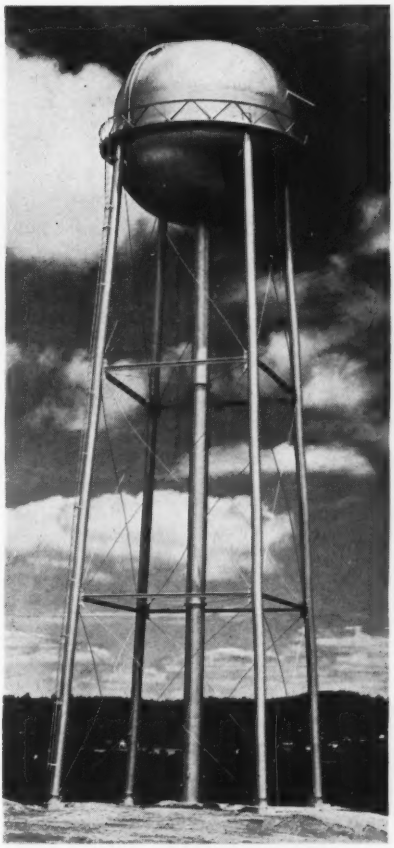

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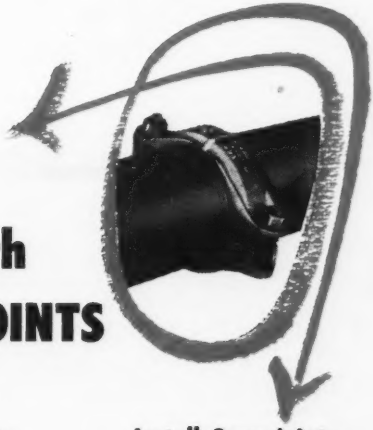
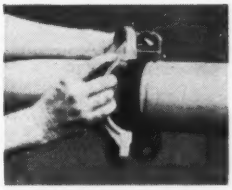
Couple Pipe the Easy, Low Cost Way with New G-B GRUVAJOINTS



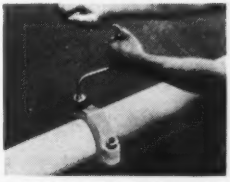
Now you can save up to 25% when connecting pipe for bulk runs and risers. Yes, contractors are saving money every day when they use new lightweight Gruvajoints. There's no flanging, no threading, no welding, and there's no need for heavy chain tongs or pipe wrenches. Gruvajoints are truly the modern way to couple pipe. Write today for free illustrated brochure on G-B Pipe Coupling Products. Gruvajoints are now available in 2", 2½", 3", 4", 5", 6" and 8" sizes.

Install Gruvajoints in three easy steps

Grease gasket and center over pipe ends.



Lay housing halves into grooves and insert bolts.

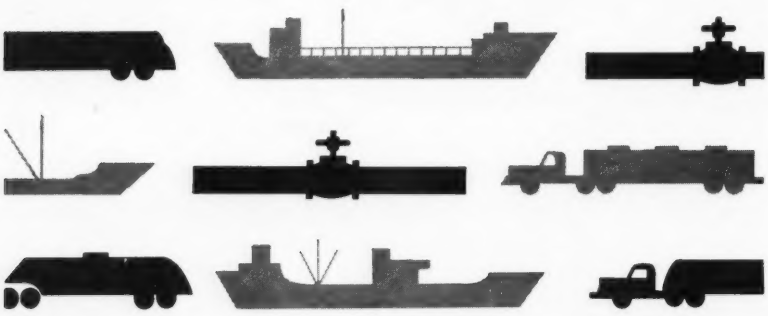


Tighten the two nuts equally.

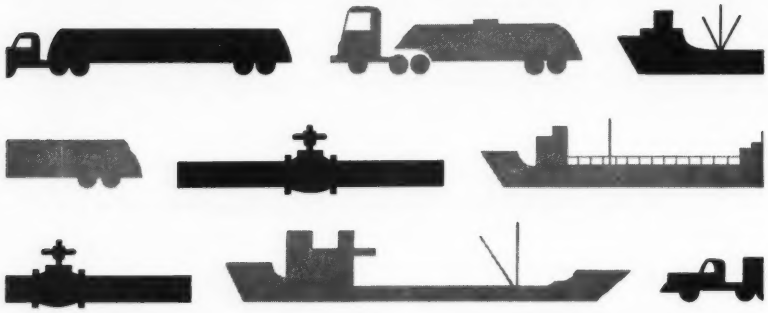
LISTED by
Underwriters' Laboratories, Inc.
File EX 1741A and B

APPROVED by
Factory Mutual Engineering Division
Report Serial No. 13097

GUSTIN-BACON
manufacturing company
210 W. 10th St. Kansas City, Missouri



FOR SAFE TRANSPORT–LAND AND SEA SHAND AND JURS TANK FITTINGS



For over 35 years, Shand and Jurs has pioneered in the design and manufacture of mechanical tank fittings for truck tanks, marine tankers and pipeline installations. S&J offers petroleum transporters the world's most complete line of valves, gages, fittings and controls for maximum safety and economy in the movement of petroleum products. Convenient Shand and Jurs branch offices and sales representatives are ready now to help you with your tank fitting problems. Call them today.

SHAND AND JURS

PRECISION INSTRUMENT CORPORATION

2600 Eighth Street, Berkeley, California
Branch offices and representatives in principal cities

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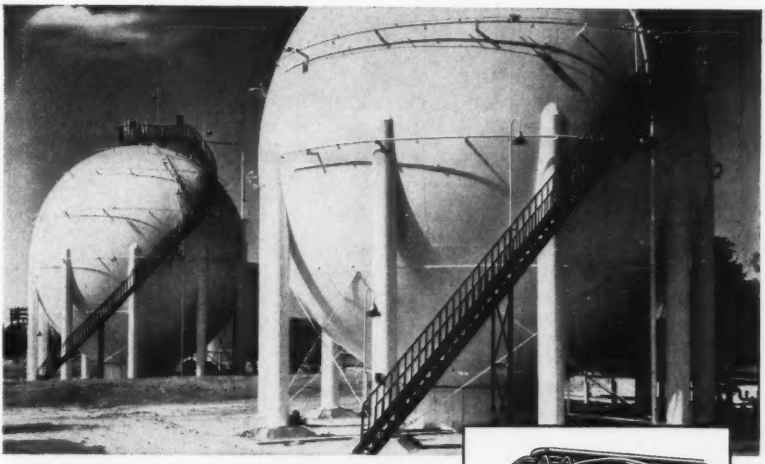

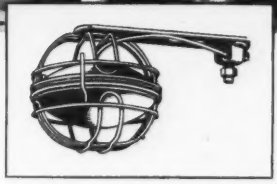

These two 55' diameter spherical tanks contain butadiene. Each sphere is protected by two automatically operated Dualguard Deluge WaterFOG Systems. These systems are designed to protect spheres from damage by fires in the sphere area . . . control fires . . . and to accelerate dissipation of flammable vapors in the event of a spill. Rockwood heat activated devices stand as sentinels in the Dualguard Deluge System.

No Balls of Fire Here!

Rockwood Dualguard Deluge Systems protect these butadiene filled tanks from fire. The system gives all the advantages of Rockwood WaterFOG plus the added feature of a *Rate-of-Rise* Heat detecting system.

And when you combine this remarkable *Rate-of-Rise* system with Rockwood WaterFOG you get protection that's unmatched.

Rockwood WaterFOG shuts off oxygen, confines and controls flammable liquid fires — *fast.*

We don't have enough room on this page to tell you all the advantages of the Rockwood Dualguard Deluge Systems — so fill in the coupon below and we'll send you full information.

ROCKWOOD SPRINKLER COMPANY

Engineers Water . . . to Cut Losses

Distributors in all principal industrial cities

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Title.....

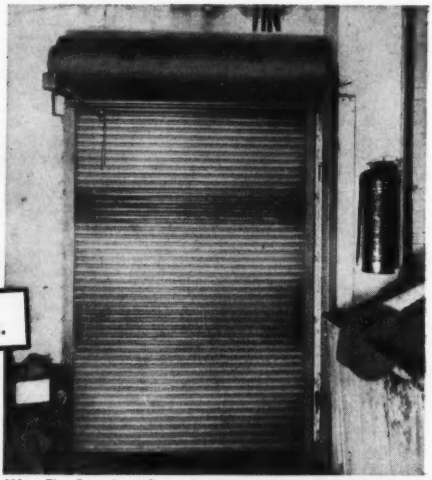
Company.....

Street.....

City.....*Zone*..*State*.....

"AKBAR"
THE FAMOUS
KINNEAR
Steel Rolling
FIRE DOOR

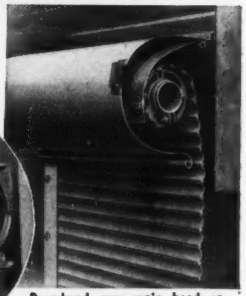
LABELED by Underwriters Laboratories, Inc.



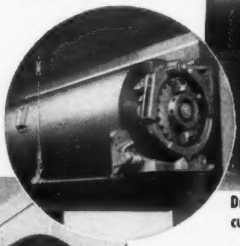
Akbar Fire Door just after confining a devastating fire to room on other side of fire wall. Note fire extinguisher still on wall.

Automatic positive-action Closure

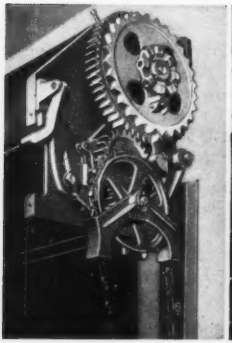
You get *positive, automatic* fire protection wherever openings are equipped with AKBAR Rolling Fire Doors (made *only* by Kinnear). The instant fire causes *automatic* release, they are *pushed* downward by a strong spring. Their closing speed is *controlled*, for safety. And they're operable *after* automatic release, for emergency exits.



Drop-hood over main hood on curtain coil.



Right and below right: Manual Akbar operating mechanism. Below left: Mechanism of chain hoist "Akbar" Fire Door.



When closed, AKBAR Rolling Fire Doors block drafts, repel flames, keep fire from spreading. Kinnear Rolling Fire Doors can also be equipped for daily service, with motor or manual operation. (Use non-labeled Kinnear Rolling Doors where fire protection is not required.) Write for full details!

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Factories:
2250-70 Fields Ave., Columbus 16, Ohio
1742 Yosemite Ave., San Francisco 24, Calif.
Offices and Agents in All Principal Cities

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ROLLING DOORS
Saving Ways in Doorways

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UNDERWRITERS' LABORATORIES, Inc.

SMALL ORIFICE SPRINKLER
(With Identifying Pintle)

1 **SUPERIOR PROTECTION** . . . due to more efficient water distribution. Proven by tests under actual fire conditions for all classes of hazards.

2 **MORE EFFECTIVE USE OF LESS WATER** . . . because wider distribution and break-up of the water discharged provides greater cooling and extinguishment.

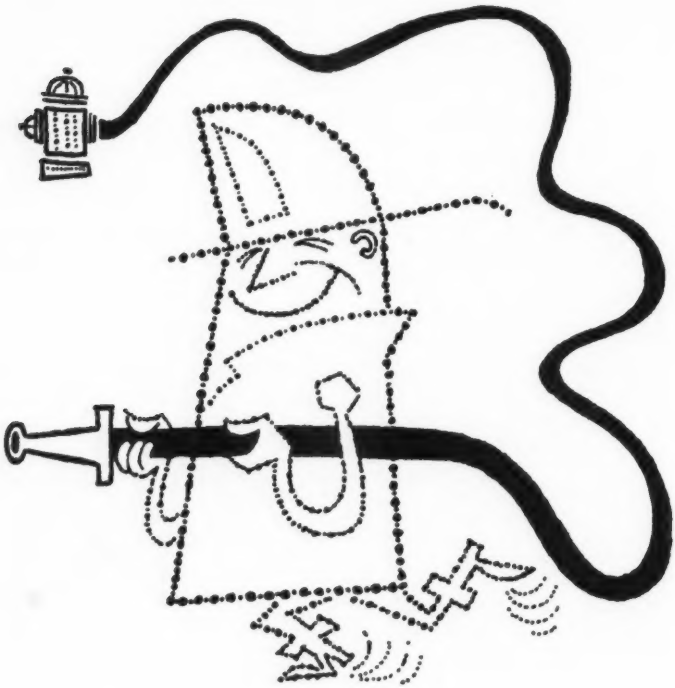
3 **CEILING PROTECTION BY COOLING — NOT WETTING** . . . All the water goes onto the fire. The break-up of water results in complete cooling and control of flammable vapors.

4 **MORE FIRE CONTROL WITH FEWER SPRINKLERS** . . . because ceiling temperatures are kept lower, fewer sprinklers open. Immediate water saturation of the fire area prevents the spread of fire. Hot gases become impotent in the cooled atmosphere.

STAR SPRINKLER CORPORATION

Westmoreland & Collins Sts., Phila. 34, Pa.

Licensees in principal cities of the United States and Canada



HEED THE FIRE FIGHTERS' ADVICE

Your local fire department performs a great public service by protecting you and your community from fire. They expend great efforts to teach fire prevention to the public.

Heed the fire fighters' advice. Protect your buildings from fire. For assured building fire protection specify a Lexsuco Fire Retardant Roof Construction. It has been tested and classified Class I by Factory Mutual.

Write today for information.

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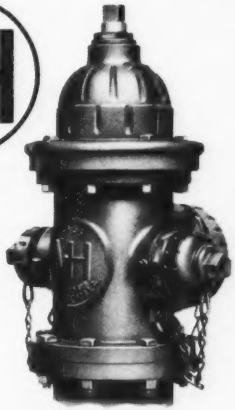
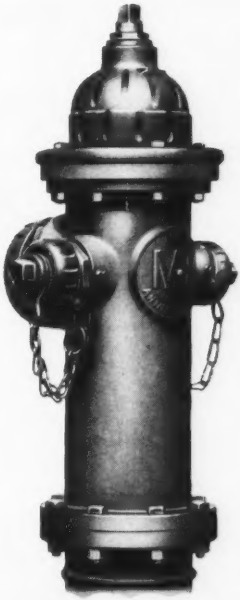
The mark of LOWER FIRE INSURANCE RATES



Standard model



Traffic model

Along the streets of hundreds of U. S. villages, towns and cities stand modern sentinels of fire protection: M & H fire hydrants. Where you see them, too, you can be reasonably sure they are the mark of lower fire insurance rates. Assuming an adequate water supply, an efficient distribution system and a fire department, M & H hydrants are the last of the four principal factors which mean good fire protection and lower insurance rates.

An M & H hydrant may long stand idle, yet functions perfectly when needed. Large inside diameter and unobstructed waterway gives high flow efficiency. Operating parts are bronze or bronze bushed. Furnished either UL & FM approved or A.W.W.A. specification, standard model, traffic model or flush type. For complete information, address

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ANNISTON, ALABAMA

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ALL BRONZE

EASY TO INSTALL

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FIRE SPRINKLER SYSTEMS AND EQUIPMENT

Engineered for better protection

ALARM VALVES
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GRIMES DEVICES ARE APPROVED BY ALL INSURANCE INTERESTS

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RAISLER CORPORATION, 129 Amsterdam Ave., New York 23
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Both vents are your Responsibility... and One can mean trouble!!

Every gas vent must be checked against local building codes. Give extra attention to those gas vents that fail to show the red-and-black Metalbestos "Safety Seal" above the gas appliance's draft hood.

The "Safety Seal" means an all-Metalbestos vent, installed according to the Metalbestos "Safety System" Tables. It means your responsibility for your neighbors' health and safety has been met by the installer's choice of vent pipe and installation method.

Look for the Metalbestos "Safety System" Seal... your assurance of scientific, safe gas venting.

For your complimentary copy of the new "Safety System" Installation Guide, contact your nearest Metalbestos representative or write Dept. T-4.

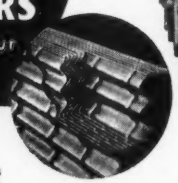
Stocked by principal jobbers in major cities. Factory warehouses in Akron, Atlanta, Dallas, Newark, Des Moines, Chicago, New Orleans, Los Angeles, Woodbridge, N. J.

METALBESTOS DIVISION
WILLIAM WALLACE COMPANY · BELMONT, CALIF.

LOW COST
FIRE & EXPLOSION PROTECTION

for FLAMMABLE LIQUID STORAGE

WITH "Varec"
FLAME ARRESTERS
in combination with your
VENT VALVES



Flame Arrester Unit
listed by
UNDERWRITERS' LABORATORIES
Approved by Associated Factory Mutuals
Laboratories and other governing agencies.

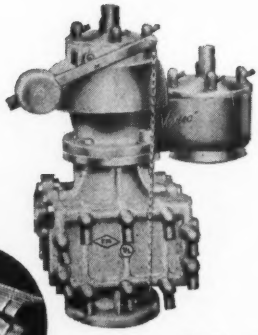


Fig. No. 5800A
Conservation Vent Unit consisting of VAREC Vent VALVE in combination with VAREC FLAME ARRESTER

You can rely on VAREC CONSERVATION VENT UNITS to provide full fire protection on your liquid storage at low cost. Protection against entry of flame through the venting device is certain when Varec Flame Arresters are used. Protection against excessive pressure or vacuum is assured by the VAREC VENT VALVE. The combination unit gives you complete security against major hazards of flammable liquid storage. Average installation costs 1/10th of 1% of your investment in tank and products. Secure full details from your VAREC Representative or write factory.

NF-3

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COMPTON, CALIFORNIA, U. S. A.

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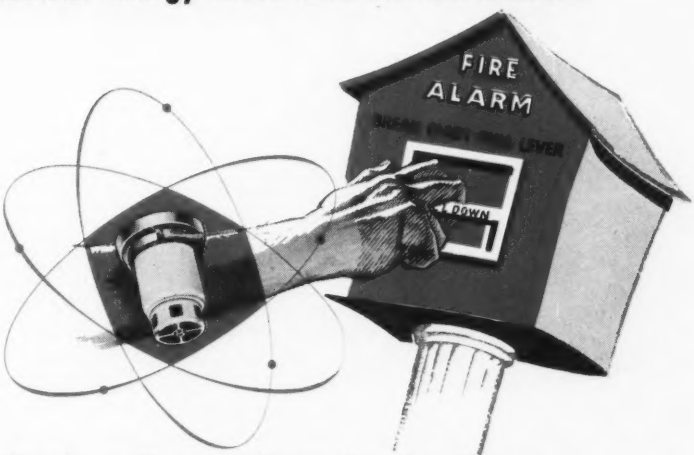
(All Codes)

Nuclear energy takes over the fire watch...



Nuclear Energy Sounds the Alarm...

Precious Minutes Earlier

In a matter of minutes the invisible beginnings of combustion can burst into flame and become a dangerous and costly fire. Conventional thermal devices, slower to detect fire in its incipient stage, lose precious time for the fire fighter.

Now nuclear energy adapted to an electronic device, saves those vital minutes, and saves lives and property too. PYR-A-LARM, the nuclear-energized pre-detector, can give warning precious minutes earlier because it is sensitive to the invisible airborne products of combustion.

We will gladly demonstrate the advantages of the modern PYR-A-LARM system in your plant. Write for complete information. *Approved by Underwriter's Laboratories Inc. and Factory Mutual Laboratories.*

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A DIVISION OF BAKER INDUSTRIES INC

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HEAVY DUTY ALARM BELLS
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Weatherproof Watertight

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Sizes 6", 8", 10". Cast aluminum housing
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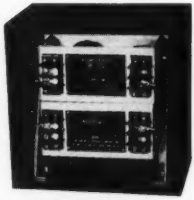
AUTOMATIC BATTERY CHARGER, High and Low Current

The unit is designed for use on any storage batteries not subject to heavy drains. It will trickle charge the battery indefinitely because of its automatically decreasing rate of charge.

For use with six cells (12 volts). Automatically controlled by saturable reactor. Continuous output one ampere. 22.5 watts, 118 volts, 60 cycles. 3% Regulation. 9" x 9" x 6" — 14 B & S gauge steel wall cabinet. 15¼ lbs. U.L. Approved. No moving parts.



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Manutacturers of a complete line of

CENTRAL OFFICE and LOCAL FIRE ALARM DEVICES

• automatic alarm devices • sprinkler alarm and supervisory devices • burglar alarm devices and accessories. DYNALARM (sound detection for both reverberant and non-reverberant vaults).

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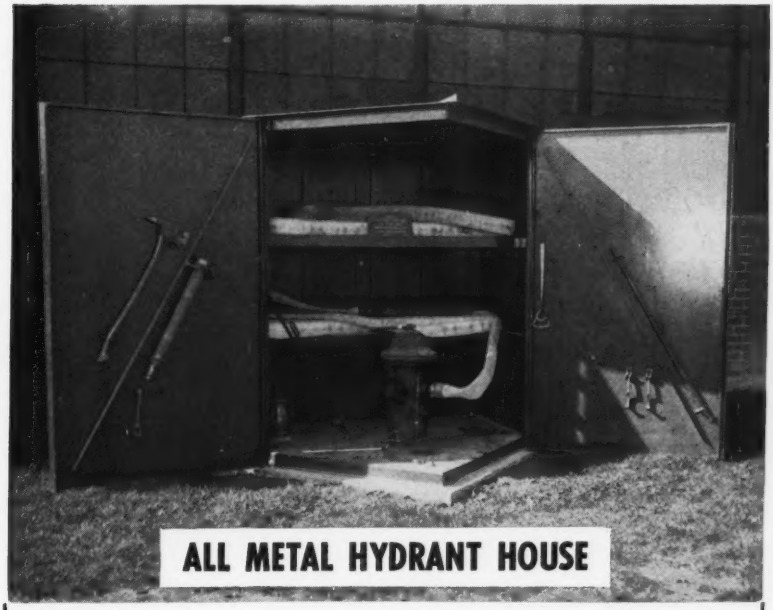

— FACTORY MUTUALS APPROVED —

Many Architects and Engineers are specifying the Model 60 ALL-STEEL Hydrant House on new jobs and recommend their use for replacement of existing wooden houses as they wear out.

The advantage of a Hydrant House is that it protects the hose and hydrant during inclement weather when sleet or snow cause heavy icing. The hose is coupled and ready at any hour of the day or night. All steel houses are weathertight and rat proof — will not warp or dry out (8) Eight Louvers are stamped in side panels for ventilation.

Doors are formed of 16 gauge metal. Roofs and side panels are 20 gauge. Shelves are perforated and formed of 14 gauge. Corner supports and hinge posts are formed of 12 gauge. Finished weight — 600 lbs.

Houses are shipped from stock, knocked down. Roof, base, shelves, doors and panels are completely prefabricated of galvanized iron with zinc plated hardware. Hinges are brass pinned. Two men with only a screwdriver and a wrench can erect it on foundations in less than one hour.

Manufactured by

VAN LOON INDUSTRIES

ENGINEERS AND FABRICATORS

3409 East McNichols Road Detroit 12, Michigan

TWinbrook 3-4460 TWinbrook 3-4461

CUSTOM HOSE CABINETS MADE TO YOUR SPECIFICATIONS

New Design Sprays Water More Evenly Over Wider Area!

It's hard to improve on the best, but we've done it! By re-designing our already superior "Automatic" Spray Sprinkler, we have come up with a model that has an even *better* distribution pattern. We also made the casting more rugged. The resultant increase in efficiency means better performance in case of fire. While we were at it, we improved our sprinkler's appearance.

Available for upright or pendant installation.

Ask your nearest "Automatic" Sprinkler fire safety engineer or write to us for complete information.

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA
YOUNGSTOWN, OHIO
OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA

"Automatic" Sprinkler

FIRST IN FIRE PROTECTION

Now! Telegraph and Voice in One Alarm Box

Gives Fastest Action for Fires and Emergencies

Now, you can have real two-in-one protection for your community . . . fast, automatic signalling for fire alarms and multi-purpose voice for general emergencies. The Gamewell "Citizen's Emergency Center," just developed as a combination system, provides the ideal type of communication for reporting the two basically different types of emergencies found in every community. The inherent speed, safety and positive identification features of telegraph fire reporting are retained — plus an independent voice circuit for reporting non-fire emergencies over a special private-line circuit to police or central switchboard. A Police Privacy Alarm System is also available.

Write for complete details! Give your community maximum protection at minimum cost. Here is the opportunity for a completely integrated and independent Fire and Emergency Alarm System always ready for use on a 24-hour basis. Ask for further details from:

GAMEWELL®

THE GAMEWELL COMPANY
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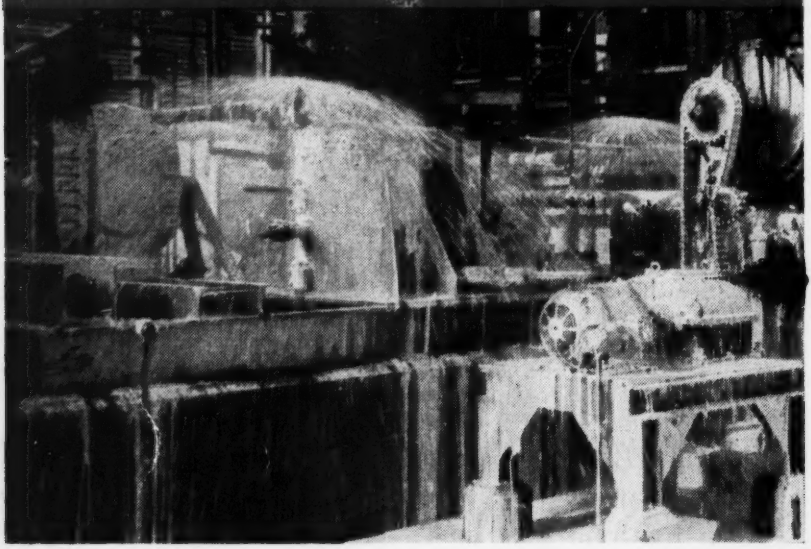
In Canada: Northern Electric Co., Ltd., Belleville, Ont.
First When Seconds Count

HEXANE SOLVENT UNIT PROTECTED BY A BLANKET OF FOAM



At Canadian Vegetable Oil Processing Ltd., Hamilton, Ontario, hexane solvent is used in extracting vegetable oil from soybeans. Because of the highly flammable nature of the solvent, Grinnell designed a special system for this unit, consisting of 24 ProtectoFoam spray heads—to blanket the diked area with foam; and 162 ProtectoSpray nozzles — to drench the superstructure with fine water spray. This foam-water combination protects the lives of personnel, as well as shielding equipment from costly damage.

Solving tough fire problems like this with installations engineered to the hazard, tailored to the need, built of highest quality materials is something Grinnell has been doing successfully for more than 85 years. Check the list below for the Grinnell System suited to your requirements. Or, tell us about the fire hazard you face, and let us suggest the proper installation for you. Grinnell Company, Inc., 277 West Exchange Street, Providence, Rhode Island.

Grinnell Fire Protection Systems include:

- Automatic spray sprinklers — wet pipe, dry pipe, Simplex, and deluge systems
- Emulsion and vapor dilution extinguishment with water sprays — Mulsifyre, ProtectoSpray and Selfcon systems
- Cooling, insulation and controlled burning with water sprays — ProtectoSpray systems
- Mechanical foam blanket — Protecto-Foam systems
- Carbon dioxide systems
- Dry chemical systems

GRINNELL Whenever Fire Protection is Involved